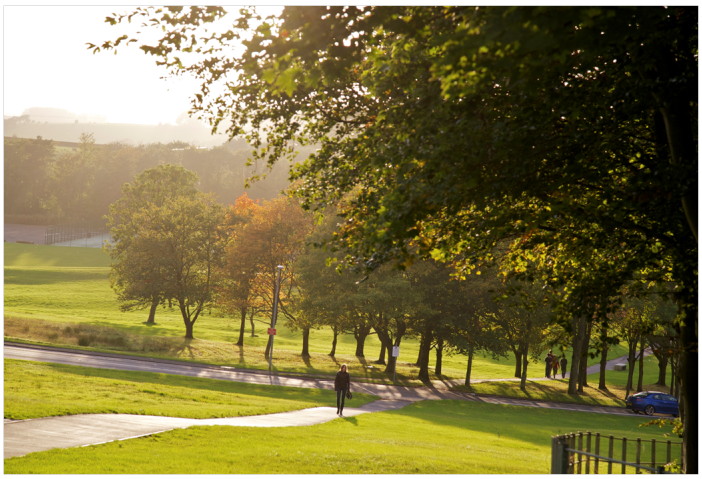
Lancaster University

Architectures and Mechanisms of Language Processing

Lancaster, September 7-9, 2017





Welcome!

We are honoured to be hosting AMLaP 2017 in Lancaster. AMLaP is now in its 23rd manifestation as the leading European venue for research into processing language from multidisciplinary and interdisciplinary perspectives. As a reflection of its success, we received 315 submissions and we are delighted with the quality of the papers representing a wide range of countries, a large number of research groups, and a breadth of approaches to language research. We are really pleased that our visiting speakers – Jeff Elman, Núria Sebastián-Gallés, Susan Goldin-Meadow, and Florian Jaeger – agreed to fly in some cases immense distances to attend AMLaP. We are also indebted to Matt Crocker and Martin Pickering – organisers of the very first AMLaP – who gave us useful advice and guidance (but not too much) in organising this event. Thanks too to the organisers of AMLaP in Malta 2015 and Bilbao 2016, who shared their experiences of organising the conference. Finally, we are deeply cheered by the language processing community, who responded with initial enthusiasm to our requests to review. AMLaP is truly a community endeavour, we couldn't do it without you.

Padraic Monaghan, Patrick Rebuschat and Francesca Citron

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Organisation

Organising committee: Padraic Monaghan, Patrick Rebuschat, Francesca Citron

Student volunteers: James Brand, Jacky Chan, Abigail Dutton, Pavlina Kutsarova, Chloe Newbury, John Shaw, Jose Luis Moreno Vega

Invaluable administrative support: Lynne Hargreaves

Contact: amlap2017@lancaster.ac.uk

URL: http://wp.lancs.ac.uk/amlap2017/

Program Committee

We are very grateful to the members of our Program Committee for their abstract reviews:

- Manon Jones
- Valentina Cuccio
- Julia Udden
- Judith Rispens
- Odette Scharenborg
- Aline Godfroid
- Colin Bannard
- Felix Engelmann
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- Mikhail Pokhoday
- Marc Brysbaert
- Vera Kempe
- Shane Lindsay
- Nicola Molinaro
- Silke Brandt
- Henning Holle
- Yulia Esaulova



Lancaster Castle (left) and The Ashton Memorial (right)

Important information

Location

- The conference will take place in the George Fox building (building 55 on the campus map: http://www.lancaster.ac.uk/maps/campus.pdf).
- Keynotes and paper presentations will take place in Lecture Theatre 1.
- Poster presentations will take place in the foyer area, i.e. the large social space outside Lecture Theatre 1.

Registration

- The registration/information desk is located in the foyer area.
- The desk will be staffed between 8:00 and 9:15 on Thursday, from 8.30 to 9:00 on Friday and Saturday as well as during coffee and lunch breaks.

Coffee breaks, lunch, and reception

- Coffee breaks, lunches and Thursday's evening reception will take place in the foyer area outside Lecture Theatre 1. They are all are included in the registration.

Travel information

- For detailed travel information, please visit http://www.lancaster.ac.uk/contact-and-getting-here/
- Local taxi services can be reached on the following numbers: +44 (0)1524 32090; +44 (0)1524 35666; and +44 (0)1524 848848.
- Visitor car parking is available on campus 24/7 and is free after 6pm. If you are visiting the campus during the day then parking charges apply. These can be purchased from any of the eleven pay and display machines across campus at a cost of 2 GBP for two hours or 5 GBP for all day. Chip and pin card payment facilities are available at several machines.
- Bus service from town to the university: The bus station is situated on Damside Street in city centre. Buses (services 2, 2A, 3, 4, X4, 42) leave for the University every five minutes on weekdays and most services also stop at Common Garden Street. Additionally, the 3A and X4 bus services run every 30 minutes between the Railway Station and the University (Monday to Saturday daytimes; hourly on Sunday afternoons and evenings).
- Bus service from campus to town: All buses drop off and collect passengers in the Underpass, situated underneath Alexandra Square. Additionally, services 3 and 4 serve the southern perimeter road around Alexandra Park. There are also bus stops directly outside the Sports Centre on the main drive.

Internet access

- To access the Visitor Wi-Fi network, simply select the “LU-Visitor” network, then follow the registration screens. Visitor Wi-Fi access will last for 24 hours. For longer access, you will need to register again.
- Eduroam network services are also available.
- For support on the day, please see one of our volunteers.

Social events

- Thursday, September 7: Evening reception
  - The reception will take place in the foyer area between 18.15 and 19.30.
- Friday, September 8: Conference dinner
  - This year’s conference dinner will be hosted at The Midland Hotel, a marvellous art deco hotel on the seafront in Morecambe.
  - Buses will leave campus at 18.30 to take guests to the venue. Buses depart from University House (building 32 on map). After dinner, buses will return guests to campus.
  - The conference dinner is not included in the registration fee. Advance booking is required via the Online Store.

Food and drink on campus and in town

- Below is a list of favourites, based on an informal survey of Lancaster linguistics and psychology staff and students.
- Options on campus (selection, note not all may be open):

Café 21	Nice vegetarian, vegan, and gluten-free food, with great views. Service can be slow at busy times.
Pizzetta Republic	Good restaurant for those who like pizza, late opening times. Good for coffee, too.
Grizedale Café Bar	Famous for Stone Willy's pizzas and hot wraps as well as dinky dipping hot donuts with a choice of sprinkles and sauces.
Sultan of Lancaster	Indian restaurant and takeaway, serves a variety of curries, chicken and wraps. Vegetarian options available. Open late-ish.
The Deli	Popular deli salad bar with fresh, homemade tartlets, a selection of meats and cheeses as well as hot roast sandwiches and filled focaccias. Vegetarian options available.
The Lounge	Restaurant on campus. Range of food buffet style, though service can be slow if busy. Also good place for a sit-down coffee.
The Mill at Fylde College	A great choice of fresh toasties and sandwiches or for something more filling, try the burgers and burritos. They serve "Primal Feast burgers, with two to choose from weekly including camel, alpaca, elk and kangaroo." Open for dinner, too.
The Trough of Bowland	Traditional homemade pie served with potatoes and vegetables from 12.00. Open for dinner, too.
Wibbly Wobbly Burger	Good burger place, not on the campus map, simply follow directions to Grizedale College. Offers vegetarian options. Open till late.

- Options in Lancaster town centre:
  - For restaurants, phone numbers are provided below. Reservations are recommended, especially for larger groups.

1725	Nice Tapas restaurant. Serves dinner until 21.30 (though open for drinks until 23.00). (Market Street, 01524-66898)
Full House Noodle Bar	Chinese, Malaysian. Very casual. Just walk through the shop and go upstairs. Shuts at 21.00. (21 Common Garden St, 01524-842888)
Kashish	Good Indian restaurant. Bring your own alcohol (which can be purchased at nearby Sainsbury's supermarket...). Open till 23.00. (32 Parliament Street, 01524-388 222)
The Hall	Serves excellent coffee from local, award-winning roastery (Atkinson's). Nice cakes, too. Shuts at 17.00. (10 China Street)
Sun Café	Very nice restaurant, Mediterranean cuisine. They also run Sun Pizza, a good pizza restaurant in the same street. (25 Sun Street, 01524-846252)
The Borough	Nice pub in town, has its own brewery. Serves food till 21.00, drinks till 23.30. (3 Dalton Square, 01524-64170)
The Water Witch	Pub next to canal in city centre. Serves food till 21.00, drinks till 23.00. (The Tow Path, Aldcliffe Road, 01524-63828)
The Tap House	Artisan brews and niche wines, good for drinks (open till midnight). (Gage Street, 01524-842232)

Family days out in and around Lancaster

- Things to do in Lancaster:
  - Williamson Park – Lancaster's favourite park offers beautiful panoramic views of Lancaster and its surrounding area. The Ashton memorial, butterfly house, mini beasts (meet Lancaster's meerkats) and bird attractions make an entertaining visit.
  - Lancaster Castle – Take a tour of Lancaster's most historic building dating back to Roman times; owned (and recently visited) by Her Majesty the Queen.
  - The River Lune – Take a stroll along the River Lune. Start along the Lancaster canal, heading north, join the river at the aquaduct. The "Crook o' Lune" was a famous Victorian tourist spot. It's still very lovely.
  - Morecambe beach and promenade – Take the train or bus to our nearest seaside town. This long stretch of beach is ideal for sandcastles providing the English summer weather is kind to us.

- If you have your own transport:
  - Old Holly Farm – Located on the A6, 5.5 miles from the University, this farm offers the opportunity to meet their baby lambs, chicks and calves alongside other farmyard animals as well as an indoor play area, café and farm shop.
  - The Pudding House, Wallings Farm – Located close to the A6, 5.5 miles from the University, the Pudding House boasts homemade, fresh food including the best ice-cream sundaes to be found. Choose from a wide range of flavours, and visit the farm animals. N.B. Don't panic if you don't have transport; we have our very own Wallings farm ice-cream shop on campus (Alexandra Square)!

- A little further afield:

- Liverpool and Manchester can be reached within 1-1.5 hours by rail from Lancaster. Here you can visit a fantastic selection of museums, theatres, shops and parks.

Sponsorship

We are grateful to the ESRC International Centre for Language and Communicative Development (LuCID) for their financial support.



View from the summit of Loughrigg Fell, Lake District

Schedule

Thursday, September 7, 2017

8.50 to 9.00 Opening remarks

9.00 to 9.20 Stefanie Roessler, Anke Holler and Thomas Weskott
Morphosyntactic Factors Modulate N1 Accessibility in Compound Processing

9.20 to 9.40 Holger Mitterer and Ingo Plag
Prefix vs suffix: Evidence for early morphological decomposition in auditory speech comprehension

9.40 to 10.00 Pelle Söderström, Merle Horne and Mikael Roll
Predicting word endings and syntactic structures with prosodic cues – the pre-activation negativity

10.00 to 10.20 Jenny Yu, Heather Kember, Robert Mailhammer and Anne Cutler
Prosodic cues to syntactic disambiguation in English and German

10.20 to 10.40 Xin Xie and Emily Myers
Inferior frontal gyrus activation is modulated by phonetic competition: An fMRI study of clear and conversational speech

10.40 to 11.10 **Coffee**

11.10 to 11.30 Simone Sulpizio, Marco Marelli, and Simona Amenta
Phonology-mediated access to semantics in visual word recognition

11.30 to 11.50 Simona Amenta, Marco Marelli, Leo Budinich and Davide Crepaldi
The interaction between context and word information in sentence reading

11.50 to 12.10 Yaling Hsiao, Helen Norris and Kate Nation
Semantic diversity affects semantic judgment by developing readers

12.10 to 12.30 Lucy MacGregor, Jennifer Rodd, Ediz Sohoglu, Olaf Hauk and Matt Davis
Neurocognitive mechanisms of semantic ambiguity resolution

12.30 to 14.30 **Lunch and Poster Session 1**
Please see page 12 for list of poster presentations.

14.30 to 14.50 Liam Blything and Kate Cain
The role of memory and language ability in children's knowledge and production of two-clause sentences containing 'before' and 'after'

14.50 to 15.10 Katherine Messenger and Sophie Hardy
Exploring the lexical boost to syntactic priming in children and adults

15.10 to 15.30 Laura Lindsay, Zoe Hopkins and Holly Branigan
A rabbit by any other name: Lexical alignment in preschoolers' dialogue

15.30 to 15.50 Stewart McCauley and Morten Christiansen
Modeling the role of predictive vs. recognition-based processing in acquisition

15.50 to 16.20 **Tea**

16.20 to 16.40 Silvia Rădulescu, Frank Wijnen and Sergey Avrutin
Statistical learning and cognitive constraints on rule induction: An entropy model

16.40 to 17.00 Jelena Mirkovic and Emma Hayiou-Thomas
The emergence and role of explicit knowledge in implicit statistical learning

17.15 to 18.15 **Keynote: Susan Goldin-Meadow**
The resilience of language and gesture

18.15 to 19.30 **Drinks reception**

Friday, September 8, 2017

9.00 to 10.00 **Keynote: Jeff Elman**
A model of event knowledge

10.00 to 10.20 Eva Wittenberg, Shota Momma, Elsi Kaiser and Jeremy Skipper
Complexity matters only when it matters: Pronominal object and event reference rapidly access different aspects of situation models

10.20 to 10.40 Wing-Yee Chow and Di Chen
Listeners rapidly use unexpected information to update their predictions

10.40 to 11.10 **Coffee**

11.10 to 11.30 Evangelia Balatsou, Simon Fischer-Baum and Gary Oppenheim
The psychological reality of name agreement in picture naming

11.30 to 11.50 Laura Frädrich, Fabrizio Nunnari, Alexis Heloir and Maria Staudte
Simulating listener gaze and evaluating its effect on human speakers

11.50 to 12.10 Yasamin Motamedi, Marieke Schouwstra, Jennifer Culbertson, Kenny Smith and Simon Kirby
Culturally evolving complex constructions in artificial sign languages

12.10 to 12.30 Leanne Nagels, Roelien Bastiaanse, Deniz Başkent and Anita Wagner
Lexical access in cochlear implant users

12.30 to 14.30 **Lunch and Poster Session 2**
Please see page 18 for list of poster presentations.

14.30 to 14.50 Miquel Llompart and Eva Reinisch
The robustness of lexical encoding in a second language is related to phonetic flexibility

14.50 to 15.10 Juli Cebrian and Joan Mora
Crosslinguistic perceptual similarity and asymmetric lexical competition in L2 spoken-word recognition

15.10 to 15.30 Robin L. Thompson and Clifton Langdon
Cross-modal bilingual activation in English and American Sign Language bilinguals: The role of language experience

15.30 to 15.50 Luca Onnis and Win Chun
Bilingualism is associated with better statistical learning

15.50 to 16.20 **Tea**

16.20 to 17.20 **Keynote: Núria Sebastián-Gallés**
Bilingualism and early language learning

18.30 Bus leaves campus for conference dinner from University House (advance booking required)

Saturday, September 9, 2017

9.00 to 9.20 Miguel Santín, Angeliek van Hout and Monique Flecken
Does the result justify the means? The representation of resultative events on Mandarin and Spanish

9.20 to 9.40 Noyan Dokudan, Mehmet Yarkın Ergin, and Pavel Logačev
Missing-VP effects in a head-final language

9.40 to 10.00 Ruth Corps, Chiara Gambi and Martin Pickering
Using content and timing predictions to prepare and articulate turns during conversation

10.00 to 10.20 Elisabeth Rabs, Heiner Drenhaus, Francesca Delogu and Matthew Crocker
The influence of script knowledge on language processing: Evidence from ERPs

10.20 to 10.40 Jennifer Arnold, Iris Strangmann, Heeju Hwang, Sandy Zerkle, and Laura Castro-Schilo
Who are you talking about? Individual differences in pronoun comprehension

10.40 to 11.10 **Coffee**

11.10 to 11.30 Maria Nella Carminati and Roger van Gompel
The lexical boost in production priming: Evidence for the special role of the verb

11.30 to 11.50 Matthew Husband and Aine Ito
Symmetric priming of enrichment in aspectual and intensional constructions

11.50 to 12.10 Sophie M. Hardy, Katrien Segaert and Linda Wheeldon
Ageing and sentence production: Effects of syntactic planning and lexical access

12.10 to 12.30 Rebecca Gilbert, Matthew Davis, Gareth Gaskell and Jennifer Rodd
Sentence-level learning mechanisms support lexical-semantic retuning during ambiguity resolution

12.30 to 14.30 **Lunch and Poster Session 3**
Please see page 24 for list of poster presentations.

14.30 to 15.30 **Keynote: Florian Jaeger**
Revisiting communicative goals in language production: Inference and adaptation (aber klar: under uncertainty)

15.30 to 16.00 **Tea**

16.00 to 16.20 Christina Kim and Vilde Reksnes
Speaker-specific expectations about precision

16.20 to 16.40 Andreas Brocher, Franziska Kretzschmar and Petra Schumacher
Discourse expectations and updating independently and additively affect pupil size in the processing of reference transfer

16.40 to 17.00 Adriana Baltaretu and Craig Chambers
Referring through rose-colored glasses: conceptual pacts under uncertainty

17.00 Closing statements

Poster presentations

Poster session 1: Thursday, September 7, 2017

1 Michael Baumann and Sandra Pappert
Temporal and benefactive for-phrases prime differently: Evidence against phrase structural accounts of persistence

2 Cylcia Bolibaugh
Lexical and conceptual anticipation in native and non-native speakers' processing of verb-noun collocations

3 Michela Bonfieni, Martin J. Pickering, Holly P. Branigan and Antonella Sorace
The interpretation of pronouns in bilingual Italian speakers: A visual world experiment

4 James Brand and Padraic Monaghan
Cognitive factors influence rate and type of linguistic change in the vocabulary

5 Angèle Brunellière, Emmanuel Farce and Isabelle Bonnotte
Typicality effects in a lexical decision task and in a categorization task. Classical or renewed interpretation?

6 Heather Burnett and Barbara Hemforth
Modelling crosslinguistic differences in pronoun resolution

7 Alessandro Caiola
The processing of argument structure in light-verb constructions: a reading-time study

8 Lucia Castillo, Holly P. Branigan and Kenny Smith
Adaptation and coordination in dialogue

9 Daria Chernova and Anastasiia Generalova
Definiteness effect on attachment ambiguity resolution in L1 and L2: evidence from French

10 Cristiano Chesi and Paolo Canal
Feature Retrieval Cost and on-line/off-line complexity in clefts

11 Jan Chromý, Štěpán Matějka and Jakub Dotlačil
Aspectual coercion and underspecification in Slavic

12 Francesca Delogu, Harm Brouwer and Matthew W. Crocker
The influence of lexical priming versus event knowledge on the N400 and the P600

13 V.A. Demareva A.V. Polevaia and S.A. Polevaia
Evidence of transfer of the L1 model of bilinguals on L2 in reading

14 Nazik Dinçtopal Deniz
Turkish speakers' use of prosody in producing and processing morphological ambiguities

15 Julia Edeleva and Valeria Demareva
The top-down and bottom-up of relative clause processing

16 Ciara Egan, Kristina Moll, Chris Saville and Manon Jones
Two orthographies in one brain: How flexible are bilinguals' reading styles?

17 Amie Fairs, Sara Bögels and Antje S. Meyer
Serial or parallel dual-task language processing: Production planning and comprehension are not carried out in parallel

18 Marion Fossard, Lucie Rousier-Vercruyssen, Sylvia Gonzalez and Amélie M. Achim
Adjustment of speaker's referential choices in a collaborative storytelling in sequence task: Effects of discourse stages and referential complexity

19 Tess S. Fotidzis and Cyrille L. Magne
Relationship between phonology, prosody and reading skills

20 Rebecca L. A. Frost, Padraic Monaghan and Morten H. Christiansen
Probabilistic use of high frequency marker words helps language acquisition

21 Teresa Garrido-Tamayo and Joaquín Gil-Badenes
which individual differences in second-language learning correlate with the tip of the tongue phenomenon?

22 Mahayana C. Godoy and Matheus A. Mafra
Pronoun interpretation in Brazilian Portuguese: Event structure can override subject-preference

23 Oleksandra Gubina and Johannes Gerwien
Gender representation and processing in Russian-German bilinguals

24 Dorothée B. Hoppe, Jacolien van Rij and Michael Ramscar
Before or after? Suffixes outperform prefixes in discrimination of L2 categories

25 Rachael C. Hulme, Daria Barsky and Jennifer M Rodd
Acquisition and long-term retention of new meanings for known words

26 Erin S. Isbilen, Stewart M. McCauley, Evan Kidd and Morten H. Christiansen
Statistical learning as chunking: A novel memory-based measure of statistical learning

27 Mina Jevtović, Vanja Ković and Guillaume Thierry
Tug of war between top-down and bottom-up processing in bi-alphabetism

28 Cheryl Frenck-Mestre, SeungKyung Kim, Hyeree Choo, Alain Ghio and Sungryong Koh
Online processing of case in Korean in native speakers and adult learners

29 Ferenc Kemény, Gyula Demeter, Mihály Racsmány, István Valálik and Ágnes Lukács
The effect of deep brain stimulation on statistical grammar learning in Parkinson's Disease

30 Elma Kerz and Daniel Wiechmann
Working memory, language experience and L2 comprehension ability

31 Evangelia Kiagia, Joan Borràs-Comes and Pilar Prieto
Mutual interactions between epistemic prosody and co-speech gestures

32 Dayoung Kim, Gyeongnam Kim and Savithry Namboodiripad
Bilingual processing of flexible constituent order in Korean

33 Suzanne Kleijn, Henk Pander Maat and Ted Sanders
Effects of syntactic dependency length on on-line text processing and comprehension

34 Dominique Knutsen, Amélie M. Achim, Arik Lévy and Marion Fossard
Does self-production affect changes in referential forms during dialogue?

35 Julia Marina Kroeger, Katja Muenster and Pia Knoeferle
Do prosody and case marking influence thematic role assignment in ambiguous action scenes?

36 Alper Kumcu and Robin L. Thompson
Lexical difficulty and looking at nothing: Less imageable and abstract words lead to more looks to blank locations

37 Enikő Ladányi, Kornél Németh and Ágnes Lukács
The role of cognitive control in garden path resolution and word production

38 Amélie la Roi, Simone Sprenger and Petra Hendriks
Context-dependent idiom processing in elderly adults: An ERP study

39 Daniel T. Lee and Hintat Cheung
Processing schematic quadra-syllabic idiomatic expressions in Chinese: structural and semantic compositionality

40 Elizabeth Le-luan, Jeffrey Wood, Bo Yao, Matthew Haigh and Andrew J. Stewart
Would you like to come up and see my etchings? Sensitivity to contextual cues in the comprehension of indirect meaning

41 Melissa Lesseur, George Christodoulides and Anne Catherine Simon

Effects of prosodic and syntactic segmentation on discourse processing and speech production

42 Saskia Leymann, Verena Haser and Lars Konieczny
Irony in visual context

43 J. Llanes-Coromina and P. Prieto
Does encouraging the production of beat gestures enhance L2 pronunciation?

44 Sergio López-Sancio and Itziar Laka
Subject island variation across dependency types in Spanish and Italian

45 Matthew Lou-Magnuson and Luca Onnis
Social network limits language complexity

46 Marco Marelli and Fritz Günther
Semantic transparency in a compositional perspective: a novel framework for compound processing

47 Katarina Marjanovič and Davide Crepaldi
Semantic and morpho–syntactic cross-word priming during sentence reading

48 Farhad Mirdamadi, Arsalan Kahnemuyipour and Julie Franck
Object attraction and the role of structural hierarchy: Evidence from Persian

49 Binh Ngo and Elsi Kaiser
Vietnamese referential forms in spoken and written narratives

50 Eva M. Nunnemann, Kirsten Bergmann and Pia Knoeferle
Triadic communication: Do human speaker and virtual agent listener gaze both influence a listener's language comprehension?

51 Luca Onnis, Stefan Frank, Hongoak Yun and Matthew Lou-Magnuson
Second-language reading patterns are associated with a statistical learning bias

52 Duygu Özge, Joshua Hartshorne and Jesse Snedeker
Referential form and implicit causality

53 C.L. Paolazzi, N. Grillo and A. Santi
Passives are not always more difficult than actives

54 Vincent Porretta and Aki-Juhani Kyröläinen
Expanding competition space: The influence of foreign accentedness on lexical competition

55 Alice Rees and Lewis Bott
A visual-world priming study of Gricean implicatures

56 Eva Reinisch, Nikola Anna Eger and Philip Hoole

Lexical effects in speech motor control do not trigger perceptual learning

57 Nick Riches, Carolyn Letts, Hadeel Awad, Rachel Ramsey and Ewa Dabrowska
Collocational knowledge in children acquiring English as a Second Language

58 Anna Samara, Daniela Singh and Elizabeth Wonnacott
Incidental learning of graphotactic patterns in word-initial and rime-level units: Evidence from English and Turkish

59 Raheleh Saryazdi, Agatha Rodrigues and Craig G. Chambers
Is referential overspecification a BIG problem, or just a problem?

60 Sayaka Sato and Panos Athanasopoulos
The cognitive penetrability of grammatical gender information during categorization

61 Sengottuvel Kuppuraj, Mihaela Duta, Paul A. Thompson and Dorothy V. M. Bishop
Online incidental statistical learning of auditory word sequences in adults: A pre- registered study

62 Iryna Sorokovska, Christine S. Schipke and Flavia Adani
Processing of case and agreement in german sentences with word order variation: eye-tracking evidence from four-year-olds

63 Katharina Sternke and Peter Indefrey
Lexical processing of monolingual homophones

64 Kate Stone, Daniela Mertzen and Shravan Vasishth
Verb particle predictability determines the facilitation effect of pre-verbal material

65 Katja Suckow and Simone Gerle
Shifting focus within sentences in anaphora resolution

66 Shira Tal and Inbal Arnon
SES differences in the structure of child-directed speech

67 Stéphan Tulkens, Dominiek Sandra and Walter Daelemans
A self-organizing model of the bilingual reading system

68 Norbert Vanek and Leah Roberts
L1-modulated sensitivity to aspectual mismatches in L2 English: an ERP study

69 Benedict Vassileiou, Lars Meyer, Caroline Beese and Angela D. Friederici
Syntax is the key to memorizing long sentences: The role of brain oscillations

70 Sandra Villata, Ludovico Franco and Paolo Lorusso
Digging-in effects in Italian relative clauses

71 Anita Wagner and Deniz Başkent
Attentional engagement versus effort in lexical access

72 Yaqi Wang and Silvia Gennari
Language-induced event schemas in memory for event duration

73 Glenn P. Williams, Anuenue Baker-Kukona and Yuki Kamide
Modulating conceptual (but not perceptual) competition in the visual world

74 Elizabeth Worster, Hannah Pimperton and Mairéad MacSweeney
Eyes movements during visual speech in deaf and hearing children

75 Hilary Wynne, Linda Wheeldon and Aditi Lahiri
Evidence for the prosodic structure of multiword utterances in L2 speech

76 Yutaka Yamauch, Nobuaki Minematsu, Kayoko Ito, Megumi Nishikawa, Kay Husky and Aki Kunikoshi
Automatic evaluation of simultaneous L2 oral reproduction tasks with a deep learning-based algorithm

77 Bo Yao and Christoph Scheepers
Direct speech quotations promote low relative-clause attachment in silent reading of English

78 Bo Yao and Sara C. Sereno
Visuo-semantic size congruency effects in concrete and abstract word recognition

Poster session 2: Friday, September 8, 2017

1 Lauren Ackerman, Nick Riches and Joel Wallenberg
The ambiguity of natural gender in coreference dependency formation

2 Ahmed Alhussein, Robert Davies and Gert Westermann
The effect of printed word attributes on Arabic reading

3 Caroline Andrews, Adrian Staub and Brian Dillon
Syntactic-adaptation vs task-adaptation: The case of object relative clauses

4 Emily Atkinson, Karen Clothier and Christiana Vargas
Artificial language learning of an optional grammatical marker

5 Nancy Azevedo , Eva Kehayia and Ruth Ann Atchley
Are neighbourhood density (N) effects influenced by age and/or language background during word recognition?

6 Julie Bannon, Rahaleh Saryazdi and Craig G. Chambers
Do older adults follow convention when designing referential expressions?

7 Eva Belke
Can phonological influences on lexical-semantic encoding in word production be regulated by the speaker?

8 Lewis Bott, Bianca Diaconu and Alice Rees
Parallel vs serial messages at the conceptual level of language production

9 Leone Buckle, Elena Lieven and Anna Theakston
Do animacy-syntax interactions influence structural priming?

10 Katy Carlson
Parallelism effects in ellipsis with and

11 Ya-Ning Chang, Padraic Monaghan and Stephen Welbourne
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The resilience of language and gesture

Susan Goldin-Meadow
University of Chicago

Imagine a child who has never seen or heard any language at all. Would such a child be able to invent a language on her own? Despite what one might guess, the answer to this question is "yes". I have studied children who are congenitally deaf and cannot learn the spoken language that surrounds them. In addition, these children have not yet been exposed to sign language, either by their hearing parents or their oral schools. Nevertheless, the children use their hands to communicate—they gesture—and those gestures take on many of the forms and functions of language. The properties of language that we find in the deaf children's gestures are just those properties that do not need to be handed down from generation to generation, but rather can be reinvented by a child de novo. They are the resilient properties of language, properties that all children, deaf or hearing, come to language-learning ready to develop.

In contrast to these deaf children who are inventing a language with their hands, hearing children are learning language from a linguistic model. But they too produce gestures. Indeed, all speakers gesture when they talk. These gestures are associated with learning, they can index moments of cognitive instability, and they reflect thoughts not yet found in speech. Indeed, these gestures can do more than just reflect learning—they can be involved in the learning process itself. Encouraging children to gesture not only brings out ideas that the children were not able to express prior to gesturing, but can also teach children new ideas not found anywhere in their repertoire, either spoken or gestured.

Gesture is versatile in form and function. Under certain circumstances, gesture can substitute for speech, and when it does, it embodies the resilient properties of language. Under other circumstances, gesture can form a fully integrated system with speech. When it does, it both predicts and promotes learning.

A Model of Event Knowledge

Jeffrey L. Elman
Department of Cognitive Science
University of California, San Diego

It has long been recognized that our knowledge of events and situations in the world plays a critical role in our ability to plan our own action and to understand and anticipate the actions of others. In recent years, it has also become increasingly clear that event knowledge may be accessed rapidly during language comprehension and may support inferences about unstated information as well as guide expectations about upcoming language. What has been less clear is what the form and structure of this knowledge is, how it is learned, and how it is accessed in real-time. In this talk I present a connectionist model of event knowledge developed by Ken McRae and myself that attempts to address these questions. The model simulates a wide range of behaviors that have been observed in humans and seen as reflecting the use of event knowledge. The model exhibits a flexibility and robustness in the face of novel situations that resembles that seen in humans. The model also makes novel and testable predictions about behaviors not hitherto observed. Most importantly, the model's ability to learn event structure from experience, without prior stipulation, suggests a novel answer to the question 'What is the form and representation of event knowledge?'

Bilingualism and early language learning

Núria Sebastián-Gallés
Pompeu Fabra University, Barcelona

How different is the process of language learning in infants exposed to two languages from birth? It was not so long ago when the available evidence pointed to a delay in language learning in bilinguals. At present, a bulk of studies claims that not only there is no delay, but that in fact bilingual exposure boosts several learning mechanisms. In the present talk I will review the empirical evidence in the field, including studies in favour of cognitive gains, but focusing on the linguistic habilities. In particular, how bilingual infants discriminate languages, how they establish their phonology and how the first words are learned.

Revisiting communicative goals in language production: Inference and adaptation (aber klar: under uncertainty)

T. Florian Jaeger, University of Rochester
(based on collaborations with Esteban Buz, Chigusa Kurumada, Scott Seyfarth, and Michael K. Tanenhaus)

In what way can communicative goals affect the processes underlying linguistic encoding? This question continues to occupy a central role in research on language production. This research has been strongly influenced by successes and failures to find "audience design" effects, such as the avoidance of lexical or syntactic ambiguities or the hypo/hyper-articulation of contextually less/more confusable utterances. What has largely been lacking from this debate is a framework that allows principled reasoning about when one would expect what type of audience design. Information theoretic considerations that re-entered psycholinguistics in the 2000s present such an approach, but suffer from a number of shortcomings (for relevant discussion, Pate & Goldwater, 2015; Moscoso del Prado Martin, lingering in hyperspace).

I outline an alternative—the adaptive speaker framework. I first discuss the central ideas and motivations behind this framework, and then illustrate its workings in a series of experiments (Buz et al., 2016, submitted; Kurumada & Jaeger, 2015). The adaptive speaker inherits from, and elaborates on, ideas from non-linguistic and articulatory motor control (e.g., forward models; task-relevance; adaptation; e.g., Jordan & Rummelhart, 1992; Guenther, 1998; Tourville & Guenther, 2011), and perception (ideal observers/ideal adapters, e.g. Clayards et al., 2008; Norris & McQueen, 2008; Feldman et al., 2009; Kleinschmidt & Jaeger, 2015).

The framework characterizes linguistic encoding as inference under uncertainty at multiple time-scales. During on-line encoding, implicit encoding decisions are assumed to be based on their expected utility with respect to present communicative intentions and goals (cf. Lindblom, 1991). This can be thought of as involving forward models that provide fast estimates of the communicative consequences of phonetic/lexical/syntactic/etc. decisions. In thinking about these consequences, it is important to keep in mind that the planning and execution of linguistic encoding is inherently noisy, resulting in variability. As in other motor systems, reducing such variability is inherently costly: optimal control typically reduces variability only along task-relevant dimensions (Todorov & Jordan, 2002; Trommerhäuser et al., 2005; Wei & Körding, 2009). I illustrate this case with data from phonetic production.

Critically, this system is assumed to be adaptive, rather than static. Speakers are predicted to adapt their productions by integrating feedback at multiple levels of encoding and multiple time scales—ranging from early conflict detection (Nozari et al., 2011), to internal monitoring (Levelt, 1989; Hartsuiker & Kolk, 2001), external monitoring of one's own speech (Guenther et al., 1998; Zheng et al., 2010), and to feedback from interlocutors (Buz et al., 2016; Schertz, 2013). Focusing on the last of these, I present evidence that the integration of feedback itself can be understood as inference under uncertainty, and that these inferences affect subsequent productions.

This type of framework, I submit, has far reaching consequences. Rather than to ask whether communicative goals *can* affects language production, it asks at what time scale it does so, depending on the type of feedback the speaker has received (e.g., during on-line encoding based on the a priori expected utility of a encoding decision; during conflict detection prior to articulation, or by adaptive changes in the forward model after a miscommunication). It also provides a novel perspective on concepts like listener-specific vs. generic audience design (Dell & Brown, 1991) or infant-/pet-/foreigner-directed speech registers.

Morphosyntactic Factors Modulate N1 Accessibility in Compound Processing

Stefanie Rößler, Anke Holler, & Thomas Weskott, Dept. of German Linguistics, Göttingen University

In his seminal work on syntactic islands, Paul Postal observed in 1969 that the first noun (N1) in an noun-noun compound (NNC) is not accessible to anaphoric processes (cf. (1)).

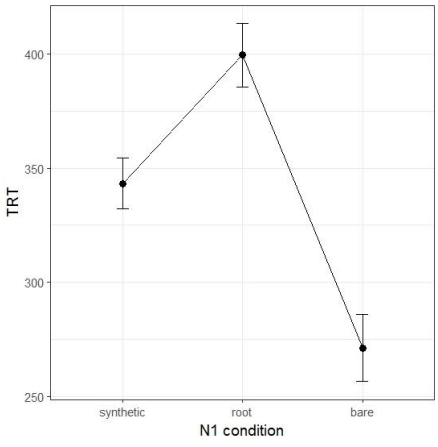
(1) *Animal$_i$ hunters tend to like them$_i$.

In the last 40 years since, the literature on NNCs and on concept combination has shown that lexical integrity and the ban on anaphors it implies are a matter of degree: the accessibility of N1s can be modulated by pragmatic factors like topicality (see, e.g., McKoon et al., 1993). However, the grammatical factors behind gradient N1 accessibility remain less understood.

We conducted an eye-tracking during reading experiment (N=27) testing the hypothesis that the morphosyntactic status of the N1 affects its accessibility. We constructed 24 pairs of NNCs, one being a root compound, the other a synthetic one. The reasoning behind this was that in synthetic compounds, the N1 is an argument of the N2 and is, according to recent syntactic theorizing, assigned the categorical status of a noun, while a root compound remains uncategorized. We predicted that an N1 of a synthetic compound should be more accessible (or less inaccessible) to anaphoric processes due to its nominal status than the uncategorized N1 of a root compound. In addition to these pairs, we tested bare N1 antecedents as a validity check. Antecedents are underlined.

Condition A (synthetic compound): Die Dachbegrünung ist wirklich gut gelungen.
Condition B (root compound): Der Dachgarten ist wirklich gut gelungen.
Condition C (bare N1): Das Dach ist wirklich gut gestaltet.
(The roof greening/roof garden/roof got to be pretty nice.)
Anaphor: Es kann… . *(It can …)*

N1s were gender-unique to enforce the intended reading of the anaphor, and were matched for length and frequency. All three conditions were presented in short discourses interspersed with 32 filler texts and were followed by a comprehension question. Participants were tested with an EyeLink1000 desk top mount system.



As Figure 1 shows, our predictions were borne out: Total RTs show that the anaphor region (anaphor plus modal verb) was indeed read faster in Condition A than in Condition B; Condition C showed the expected shortest RTs. Interestingly, the advantage for Condition A as compared to B was already visible on early measures, i.e. First Pass RTs. We interpret this as an effect of the internal structure of the NN (see Harley, 2009): N1 (in)accessibility is thus a direct outcome of morphosyntactic structure building. Our findings are further backed up by completion data showing similar effects. To our knowledge, these results are the first to show a clear effect of a morphosyntactic factor on early eye tracking measures in NNC processing.

Postal. P. (1969): Anaphoric Islands. In: Binnick, R. et al. (eds.): *Papers from the Fifth Regional Meeting of the Chicago Linguistic Society.* Chicago, April 18-19. Chicago: University of Chicago, 205-239.

McKoon, G., Ward, G., & Ratcliff, R. (1993): Morphosyntactic and Pragmatic Factors Affecting the Accessibility of Discourse Entities. In: *Journal of Memory and Language* 32, 56-75.

Harley, H. (2009): Compounding in Distributed Morphology. In: Lieber, R. & Stekauer, P. (eds.), *The Oxford Handbook of Compounding*, Oxford/New York: OUP, 129-144.

Prefix versus suffix: Evidence for early morphological decomposition in auditory speech comprehension

Holger Mitterer
University of Malta

Ingo Plag
Heinrich-Heine Universität Düsseldorf

Work on morphological decomposition in word recognition has mostly focused on the visual modality, with evidence for early decomposition (Beyersmann, Castles, & Coltheart, 2011). This cannot be straightforwardly generalized to the auditory modality, where the morphological structure of a word unfolds over time rather than space. Possibly, full-listing is more prominent in the auditory modality. Testing the time-course of recognition for auditory morphologically complex words is, however, difficult in Indo-Germanic languages.

The Semitic language Maltese, however, allows for such a test, because person/gender information in verbs is indicated as a prefix in the present tense (e.g., *jikteb-titkeb*, Engl., 'he/she writes') but as a suffix in the past tense (e.g., *kiteb-kitbet*, Engl., 'he/she wrote'). Since these affixes also function as pronouns, which can trigger early looks to male versus female referents in visual-world paradigms (Arnold, Eisenband, Brown-Schmidt, & Trueswell, 2000), the following prediction can be made: If morphological decomposition is early, looks to a (fe)male referent given a (fe)male affix should be faster in the present tense (=prefix) than in the past tense (=suffix). To test this, we generated 80 scenarios with two picturable objects presented on the screen (one each grammatically male/female in Maltese, e.g., motorbike$_{ml}$/car$_{fml}$), a lead-in sentence (e.g., *Ben owns a car and a motorbike)* followed by a question (e.g., *which one is more trouble?*) and a sentence answering the question ("She breaks down a lot"). Participants' task was to answer the question by clicking on the respective object based on the information in the final sentence (here, the car). The critical verb was sentence-initial in the task-relevant final sentence, indicating the target either at the onset (*jieqaf*/*tieqaf*, he/she breaks down) or offset (*waqaf*/*waqfet*, he/she broke down) of the first word. To prevent strategic processing, an equal number of fillers was included in which the sentence-initial word started with /t/ or /j/, but was not task relevant (e.g., *jumejn ilu*, Engl., 'two days ago').

Results revealed earlier looks to the intended target when the verb was in the present tense (=gender-marked prefix) than when the verb was in the past tense (=suffix). This could also be explained by a full-listing model based on the assumption that the cohort of activated words after hearing /tV/ (or /jV/) contains many words that indicate a female (respectively male) actor. Since the cohort of /jV/-initial words contains 75% verbs (3rd male) but the cohort of /tV/-intial verbs only 18% (3rd female), such a cohort explanation predicts the past-present tense difference to be larger for male targets. Since the effect was similar for both male (= /j/-initial) and female (=/t/-initial) targets, the results are best explained by the assumption that listeners immediately attempt morphological decomposition when they hear a segment that potentially is a prefix. In line with this assumption, we also find looks to male, respectively female, objects in fillers with /j/-, respectively /t/-initial word in sentence-initial position. It hence appears that listeners try to morphologically decompose spoken words immediately.

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Predicting word endings and syntactic structures with prosodic cues – the pre-activation negativity

Pelle Söderström, Merle Horne & Mikael Roll
Lund University

In the present contribution, we describe a brain potential – the pre-activation negativity (PrAN) – which has been found to be linked to predictive certainty as regards upcoming linguistic information, both at the lexical and the syntactic level. PrAN has been seen to be elicited by tonal features that can be used as cues to what is coming next in the speech signal, e.g. how a word is going to end. In Söderström, Horne, Frid, and Roll (2016), PrAN was found to increase in amplitude as the number of possible word endings – following a stem tone – decreased. It was suggested that PrAN reflects a mechanism where strongly predicted items are pre-activated before they are heard. In support of this, the amplitude of PrAN has also been found to correlate with listener accuracy in restoring the meaning of replaced but predicted linguistic information (e.g. word endings replaced by coughs) (Söderström, Horne, & Roll, 2016). The mechanism underlying the PrAN found at the lexical level appears to be subserved by left-lateralised temporal areas, as well as the left inferior frontal gyrus. Specifically, pre-activation of word endings seems to take a more direct route involving areas in the superior temporal gyrus (Roll et al., 2015), when the prosodic cue is more predictive, e.g. associated with a well-defined set of word endings, whereas prefrontal areas are additionally recruited when a cue is less predictive, e.g. associated with a larger, more heterogeneous set of endings. Parietal areas – the angular and supramarginal gyri – have also been implicated in word-ending pre-activation based on more predictive prosodic and segmental cues (Söderström et al., submitted, Roll et al., submitted).

Investigating whether PrAN exists as an index for sentence-level predictions as well, we recently found the effect in response to a tonal cue that signals whether an upcoming clause is a main or subordinate clause (Söderström et al., submitted). Thus, PrAN also reflects syntactic prediction and is as such not just a word-level phenomenon. The syntactic PrAN was found to be subserved by brain areas previously implicated in syntactic processing, e.g. the pars opercularis of the left inferior frontal gyrus (BA44).

In conclusion, we have found evidence for a brain potential which indexes neural mechanisms involved in the prediction and pre-activation of linguistic stimuli following tonal cues.

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Prosodic Cues to Syntactic Disambiguation in English and German

Jenny Yu[1,2], Heather Kember[1,2], Robert Mailhammer[1], and Anne Cutler[1,2]
[1]The MARCS Institute, Western Sydney University, Australia
[2]The ARC Centre of Excellence for the Dynamics of Language, Australia

English and German have similar intonation systems, but may use pitch differently to disambiguate syntactic structures. To distinguish verb-phrase (VP) attachments (e.g. *The man **visited** the zoo **with his niece***) from noun-phrase (NP) attachments (e.g. *The man visited **the zoo with the tigers***), for example, both language groups tend to lengthen the direct object e.g. '*zoo*' in VP-attachments, but the verb e.g. '*visited*' in NP-attachments; however, German speakers further mark the boundary in the VP-attachment case with a pitch rise on the direct object (Snedeker & Trueswell, 2003; O'Brien et al., 2014). In a visual world experiment, we examine whether this production difference in pitch cues for temporarily structurally ambiguous sentences affects the time-course of disambiguation by listeners across languages. We predict that if the additional pitch rise cue is significant in helping to distinguish the two types of attachment in German, then native listeners should disambiguate at an earlier time point in German than in English.

We created English and German sentences with temporarily ambiguous syntactic structures, as above, with a phrasal attachment to either the noun or the verb. For each experimental item, a scene was created comprising four pictures placed randomly in four quadrants. Two pictures depicted NP-related objects (e.g. tiger, lion) and two pictures depicted VP-related objects (e.g. niece, nephew).

Native English and German speakers listened to recorded sentences in their L1 and their eye movements were tracked as they inspected a scene. The influence of prosodic cues on disambiguation was measured by comparing the proportion of anticipatory eye movements directed to VP vs. NP pictures over the course of sentences. Based on prior findings, we predicted earlier use of prosodic cues by the German listeners.

Preliminary results indicate that both English and German listeners prefer looking at NP related objects over VP related objects before the arrival of disambiguating information, regardless of attachment type. However, a more sensitive time course analysis will more accurately determine when disambiguation occurred and whether either group was faster in doing so. In addition, we will explore the learning trajectory of participants to investigate whether English and German speakers benefited more from prosodic cues over time.

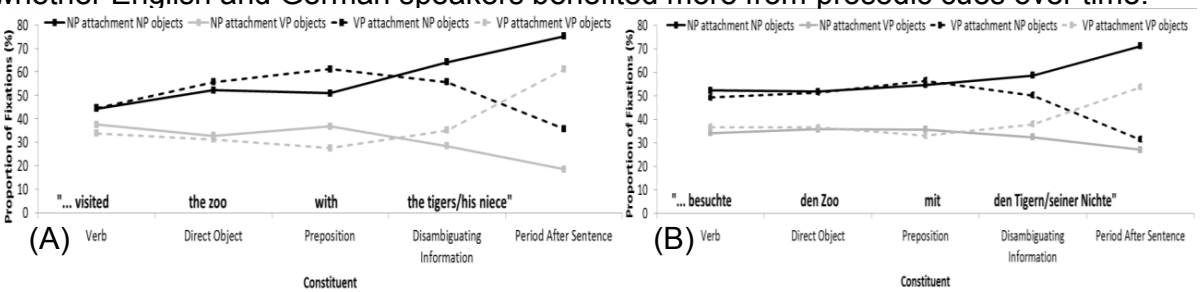


Figure 1. Average proportion of looks to NP and VP objects during sentence constituents as utterances unfolded (preliminary data from 15 English participants (A) and nine German participants (B), from a planned total of 24 participants per group).

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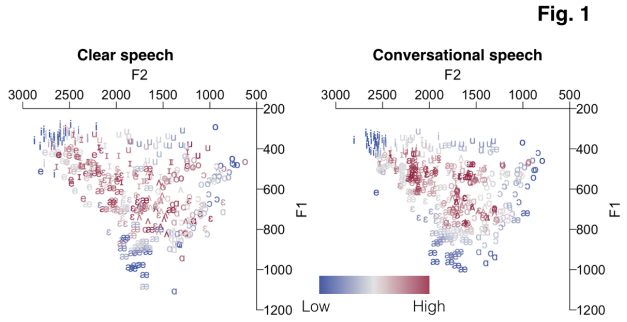
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Inferior frontal gyrus activation is modulated by phonetic competition: An fMRI study of clear and conversational speech

Xin Xie, University of Rochester & Emily B. Myers, University of Connecticut

The speech signal varies naturally in phonetic ambiguity. For instance, conversational speech, is spoken with less articulatory precision than clear speech, leading to greater potential for confusability at the phonetic level[1]. Current psycholinguistic models assume that ambiguous speech sounds activate more than one phonological category, and that competition at prelexical levels cascades to lexical levels of processing. Previous research[2,3] suggests that phonetic competition modulates activity in the left inferior frontal gyrus (LIFG), yet these studies have often used artificially manipulated speech and/or metalinguistic tasks that may tap a different set of cognitive processes than those necessary for natural language processing[4]. In the current study, we exploited the natural variation in phonetic competition (PC) in the speech signal in order to investigate neural sensitivity to PC as listeners engaged in a receptive language task.

Fifteen participants heard nonsense sentences spoken in either a *Clear* or *Conversational* register (all highly intelligible; pre-equated in pitch and duration) as neural activity was monitored using fMRI. *Conversational* sentences contained greater PC, as estimated by measures of vowel confusability (Fig.1). A post-scanner probe matching test revealed longer RTs to *Conversational* sentences than to *Clear* sentences (p = .05), suggesting that higher PC led to greater perceptual difficulty. Critically, *Conversational* sentences elicited greater activation in a region in the LIFG, whereas the opposite pattern was observed in the temporal lobe (Fig. 2A). Sentence-level PC metrics also uniquely correlated with LIFG activity (Fig. 2B), explaining variance not shared by RT or intelligibility or lexical properties of words (word frequency and neighborhood density).



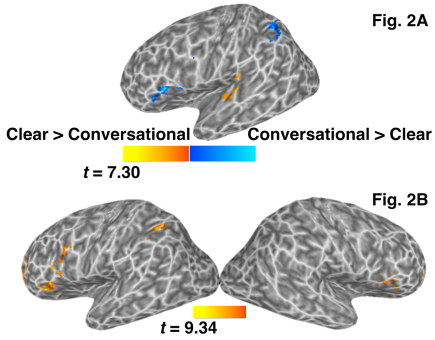


Fig.1 Phonetic competition measures for vowels in individual content words from *Clear* (left) and *Conversational* (right) sentences, coded according to the degree of Phonetic Competition each token is subject to, from Low (blue) to High (red), plotted in F1-F2 space.
Fig.2 A: Blue shows areas with greater activation for *Conversational* than *Clear*, yellow shows the opposite. **B:** Sentence-level amplitude-modulated analysis, showing areas where by-trial activation fluctuates with by-trial measures of phonetic competition. All regions show a positive correlation between phonetic competition and activation. Clusters at a corrected $p < 0.05$ (voxel-wise $p < 0.005$, minimum 59 voxels per cluster).

Conclusion: Our findings reveal a critical role of LIFG in the resolution of phonetic competition that is inherent to spoken language processing, consistent with the notion that recruitment of this region does not require an explicit phonological judgment.

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Phonology-mediated access to semantics in visual word recognition

Simone Sulpizio[1], Marco Marelli[2], & Simona Amenta[3]
[1] Vita-Salute San Raffaele University, Milan, Italy
[2]University of Milano-Bicocca, Milan, Italy
[3]Ghent University, Ghent, Belgium

In the present study, the role of phonological information in visual word recognition is investigated by adopting a large-scale data-driven approach that exploits a new consistency measure based on distributional semantics methods.

Recently, it was shown that the consistency between an orthographic string and the meanings to which it is associated in a large corpus is a relevant predictor in lexical decision experiments (Marelli et al. 2015). Orthography-Semantic Consistency (OSC) is a measure of how well the meaning of a given word can be predicted from its form, and is operationally defined as the degree of relatedness of a word meaning and the meaning of all the members of its *orthographic family*, that is all the words that "contain" the target word. Mathematically, OSC is computed as the frequency-weighted average semantic similarity between the vector of a given word and the vectors of all its orthographic relatives. Marelli et al. showed that OSC has a general effect in visual word recognition by testing it on 1821 words randomly selected from the stimuli included in the BLP database (Keuleers et al., 2012).

Exploiting irregular mappings between orthography and phonology in English (e.g., *-ough* is pronounced differently in rough, dough, through, thought, although), we were able to compute a Phonology-to-Semantics Consistency measure (PSC) that dissociates from OSC. Analogously to OSC, PSC is computed as the degree of relatedness of a word meaning and the meaning of all the members of its *phonological family*. We defined as phonological relative each word that, in its phonological form, contains the phonological sequence of the target word (e.g., "cognac"-/ k njæk/ for "yak"-/'jæk/).

We tested both OSC and PSC on lexical decision response latencies to 533 words containing grapheme sequences that are associated to multiple phonological forms extracted from the BLP. This criterion was aimed at maximizing the difference between the semantic information associated to the orthographic form vis-a-vis the phonological form, as captured by OSC and PSC.

Results showed that both orthography and phonology are activated during visual word recognition. However, their contribution is crucially determined by the extent to which they are informative of the word semantics, with phonology playing a crucial role in accessing word meaning. This is a direct evidence that readers use phonological information to activate semantics, even when the task would not apparently require it (visual word recognition).

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The interaction between context and word information in sentence reading

Simona Amenta [1], Marco Marelli [2], Leo Budinich[3], Davide Crepaldi [3]
[1] Department of Experimental Psychology, Ghent University, Ghent, Belgium
[2] Department of Psychology, University of Milan-Bicocca, Milan, Italy
[3] Department of Cognitive Neuroscience, SISSA, Trieste, Italy

There is quite wide-spread consensus that language comprehension is predictive (e.g., De Long et al., 2005): when reading "It was windy so the boy went out to fly a...", readers expect "kite" as sentence completion. Linguistic prediction has been extensively studied in psycholinguistics especially by means of Event-Related Potentials (ERPs), showing that our brain produces a specific electrical response (N400) upon encountering a word that is not expected, given its preceding context. However, the preceding context is not the only source of information available during reading. Research on word recognition indicated that some orthographic forms can be more or less good cues for their corresponding meanings on the basis of semantic relations acquired through language usage, and this impacts on the ease of recognition (Marelli et al., 2015). This evidence suggests that, in sentence reading, the processing of a given word should be influenced by an interplay between the context preceding it, and its internal form-meaning dynamics.

In the present study we test the hypothesis that, during sentence reading, prediction gathers on two sources of information: (a) expectations concerning the upcoming word based on the preceding context, and (b) expectations concerning the meaning of the upcoming word on the basis of its orthographic features. We tested the effects of both these components in modulating ERP responses recorded in natural sentence reading (Frank et al., 2015). The former, namely context-based word predictability, was operationalized in terms of surprisal (i.e., the extent to which a word is unexpected, formalized as the reverse of the log-probability of a word given the words that come before it). The latter was captured by the Orthography-Semantics Consistency (OSC), computed as the frequency-weighted average semantic similarity between the meaning of a target word and the meanings of all the other words that contain it (i.e., its orthographic relatives).

In the ERP analysis both surprisal and OSC were introduced as predictors of ERP responses in a Generalized Addictive Mixed Model, together with other relevant predictors. The non-linear interaction between the two predictors expressed itself differently for different ERP components. The effect was particularly clear for N400. For this component, results indicated that N400 amplitude is mainly affected by surprisal: the higher the surprisal, the more negative the component. However, this effect is modulated by OSC. When OSC is high, the effect of surprisal is stronger, with increased N400 amplitude for high surprisal value. These results indicate that prediction (as captured by N400) is modulated by context-base expectancies as well as the semantic network activated by the upcoming word.

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Semantic Diversity Affects Semantic Judgment by Developing Readers

Yaling Hsiao, Helen Norris, Kate Nation (U of Oxford)

The variability of the contexts a word appears in is associated with advantages in lexical decision in adults, beyond those associated with frequency (Adelman et al., 2006, Hoffman et al., 2013; Jones et al., 2012). The opposite effect is seen in semantic judgment, with more diverse words showing a processing disadvantage, perhaps due to increased competition (Hoffman et al., 2013; Hoffman & Woollams, 2015). Children show similar effects of contextual variation in lexical decision (Perea et al., 2013; Hsiao & Nation, 2016) but no study thus far has examined its effect on children's semantic processing.

We used Hoffman et al.'s (2013) semantic diversity metric to quantify the degree of contextual variability of words, calculated with Latent Semantic Analysis across a 35-million-word developmental corpus of written language. We then selected words varying in semantic diversity to use in three semantic judgment tasks: animacy (nouns only), synonym and antonym (wide range of word classes). Fifty-four children (8-11 years) participated in all three tasks. They made yes/no decisions to indicate whether the word meant a living/non-living thing (animacy), whether the word pair was similar/unrelated in meaning (synonym) or opposite/unrelated in meaning (antonym). Sixty trials were created for each task, with 30 words in each of the high vs. low semantic diversity condition. Words were matched across conditions for frequency, document count, word length, concreteness and word prevalence.

As shown in Figure 1, performance varied across tasks with the animacy task being easiest. Mixed effects models were fitted to the data with fixed effects of diversity and task and random effects of participants and items. There was a significant effect of diversity on accuracy in the animacy task: the higher the diversity of the words the higher the accuracy. Diversity was also associated significantly with RT in the antonym task, with children responding more slowly to high semantic diversity words.

Our findings did not entirely mirror those seen in adults. The diversity effect interacted with task demands: when the semantic judgment involved single words and a specific semantic aspect (animacy judgment), diversity showed a processing advantage. When two or more words had to be compared for global meaning (synonym/antonym judgment here, and also in Hoffman et al. with adults), increased diversity slowed processing, consistent with increased competition. The fact that the antonym task was cognitively demanding (children had to press yes if the words had opposite meanings), perhaps further compounded this effect. Our findings suggest that semantic diversity does not have a uniform effect in children but one that varies with task demands. This also calls for further investigation of the effects of semantic diversity on processing in adults, using a wider range of tasks.

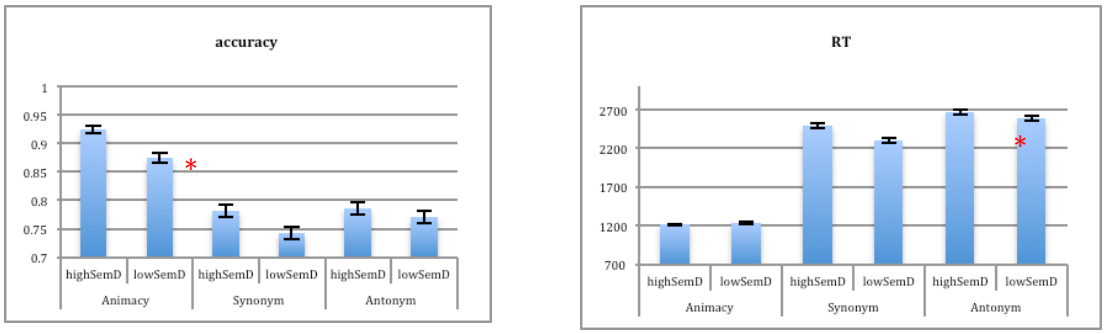


Figure 1. Mean (SE) accuracy and RT (correct trials only) in the three tasks

Neurocognitive mechanisms of semantic ambiguity resolution

Lucy J MacGregor[1], Jennifer M Rodd[2], Olaf Hauk[1], Ediz Sohoglu[1] and Matthew H Davis[1]
[1]MRC Cognition and Brain Sciences Unit, Cambridge, [2]University College London

Most words are semantically ambiguous, taking on different meanings in different contexts. Listeners use context and previous experience to make sense of – resolve – ambiguity. Resolution is particularly challenging when the disambiguating information is delayed until *after* the ambiguous word and supports a non-dominant (subordinate) meaning. Such sentence structures often require sentence reinterpretation for accurate comprehension. Previous brain imaging research on semantic ambiguity resolution has highlighted the importance of left inferior frontal gyrus, and left posterior temporal lobe regions. However, these fMRI[1,2] studies struggle to tease apart the time course of distinct cognitive operations: (i) the initial activation/selection of a meaning in response to the ambiguous word itself, and (ii) subsequent sentence reinterpretation. Here we used MEG to measure the neural responses associated with these cognitive processes.

Participants (N=20) listened to sentences presented in a 2X2 design that manipulated the presence of an ambiguous word and subsequent disambiguation (e.g., Sally worried that the *ball/pub* was going to be too *crowded/expensive*). An ambiguous word (*ball*) should require additional meaning selection processes relative to a matched control (*pub*). A disambiguating sentence-final word (*crowded*) resolved the ambiguity to a non-dominant meaning and should induce reinterpretation processes compared to a final word (*expensive*) that is consistent with both meanings. Listeners judged whether occasional visually-presented probe words were related to the preceding (filler) sentence. After MEG data collection, we assessed comprehension skill by asking participants to define the ambiguous words in sentences resolving to a non-dominant meaning, and administered tests of verbal and non-verbal IQ (Mill Hill Vocabulary; Cattell Culture-Fair Tests).

Analyses of evoked MEG responses (gradiometers, RMS transformed) time-locked to the ambiguous word revealed greater activation for ambiguous compared to control words (cluster corrected, $p<.05$) over left fronto-temporal sensors 392-800ms after word offset. This relatively late response likely reflects post-access processes involved in maintenance of alternative meanings/predictions, or suppression of the non-selected meaning. The amplitude of the MEG response correlated positively with individual differences in comprehension skill, suggesting an association with successful comprehension. Comprehension success was further predicted by participants' vocabulary scores, but not by non-verbal IQs. Source estimation localised maintenance or selection processes to right inferior frontal and anterior inferior temporal regions, somewhat consistent with fMRI evidence[1].

Reinterpretation was associated with marginally-increased neural activity (cluster, $p=.08$) over bilateral temporal sensors around sentence offset (-196-156ms). Behavioural analysis showed that sentences with more surprising (subordinate) disambiguating words were less well comprehended. However, we did not see a positive correlation between surprisal and MEG responses suggesting that reinterpretation processes may be less apparent in evoked MEG responses than in fMRI[2], perhaps due to variability in timing of the processes over participants and items. These findings inform our understanding of the neural and cognitive mechanisms of successful semantic ambiguity resolution.

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The role of memory and language ability in children's knowledge and production of two-clause sentences containing 'before' and 'after'.

Liam Blything and Kate Cain (Lancaster University, UK)

Temporal connectives are cohesive devices, such as 'before' and 'after', that speakers can use to link clauses in a sentence to signal temporal order. Although children produce sentences containing 'before' and 'after' from around 3 years of age, they have difficulties with correct usage up to at least 9 years (Peterson & McCabe, 1987). We conducted a developmental investigation of 3- to 6-year-olds' production of two-clause sentences linked by 'before' or 'after' to identify the age at which children accurately use these connectives to signal the relation between two events and reasons for failure to produce these processing signals. The differing structural demands of these target sentences, as well as the use of independent measures of memory and language, afforded us to investigate the recent claim that language skills account for the influence of working memory on sentence processing (Van Dyke, Johns, & Kukona, 2014).

In two experiments, children viewed an animated sequence of two actions, and were asked to describe the order of events in specific target sentence structures. We manipulated whether the target sentence matched the chronological order of events: 'He finished his homework, before he played in the garden' (chronological order) vs 'Before he played in the garden, he finished his homework' (reverse-chronological order); and whether the connective was linked by 'before' or 'after' ('after' is considered more semantically complex and is used more broadly as a grammatical device). In a sentence repetition task (Experiment 1), the participant heard a target sentence and was asked to repeat it. In an elicited production task (Experiment 2), four blocked sessions were each preceded by a training phase in which children were instructed to use one of the four target sentence structures. Experiments 1 and 2 both included an independent measure of working memory and receptive vocabulary.

In both experiments, children were significantly less likely to accurately produce target sentences when the presentation order of the two clauses did not match the chronological order of events, specifically for target sentences linked by 'after'. Also, our independent measure of language ability was a stronger predictor of performance than our independent measure of memory. Together these findings indicate that performance was related to variability in language skills (i.e., knowledge of connectives and other words in the sentence), rather than poor memory capacity per se.

The experiments complement each other by using different ways to elicit speech whilst replicating the main finding of children's difficulty in producing reverse-chronological order sentences linked by the connective 'after'. Nevertheless, we will also discuss how performance varied across the two tasks. We conclude that the pattern of performance on different sentence structures and in relation to independent measures of vocabulary and memory supported the hypothesis that language ability is the primary influence on children's production of these multi-clause sentences and that working memory has only an indirect influence (Van Dyke et al., 2014).

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Exploring the lexical boost to syntactic priming in children and adults.

Katherine Messenger, University of Warwick & Sophie M. Hardy, University of Birmingham

Syntactic priming effects provide strong evidence that children and adults recruit abstract representations of syntactic structure during language processing[1]. What is currently less clear in children is the interaction of such representations and lexical content in syntactic priming. The role of lexically-specific vs abstract representations in children's syntactic development is a persistent question, and lexical effects have been highlighted as key evidence for or against different mechanisms of syntactic priming[2]. As such, further research on the interaction of syntactic priming and lexical content is important.

Adults show an increase in syntactic priming (*lexical boost*) when the verb of prime and target sentences overlaps. This is argued to reflect increased activation of syntactic representations, verb lemmas, and the links between them[3]. More recently it has been proposed that syntactic priming and lexical boost effects are dissociated, with the former related to sentence processing mechanisms and the latter related to explicit memory[2]. This argument makes developmental predictions for lexical boost effects in children, but support for these is mixed: while one study showed the predicted weaker lexical boost in children relative to adults[2], another found comparable lexical boosts in children and adults[4]. However, these studies differed in the syntactic structures tested and the syntactic priming task, thus the discrepancy in findings may be related to either or both of these factors.

The present study aims to extend these findings on lexical boost in children and uncover which of these factors influence it. We tested syntactic priming and verb lexical boost for double object (DO) vs prepositional object (PO) datives in children and adults (as in[2], cf.[4]) in a dialogue task (as in[4], cf.[2]). To further test the prediction that explicit memory for lexical cues boosts syntactic priming, we manipulated overlap on the post-verbal noun, the point of structural distinction in datives. 4-year-olds and adults completed a picture-description task alternating describing pictures with the experimenter (the experimenter's description constituted the prime; the participant's description constituted the target response). We manipulated prime structure (PO vs DO) and the prime overlap (no overlap (1a) vs verb overlap (1b) vs noun overlap (1c)) with the target (2) within-participants.

(1a) Prime: a rabbit is showing (DO) the nurse a mouse / (PO) a mouse to the nurse

(1b) Prime: a rabbit is **giving** (DO) the nurse a mouse / (PO) a mouse to the nurse

(1c) Prime: a rabbit is showing (DO) the **clown** a mouse / (PO) a **gnome** to the nurse

(2) Target: a *dog **giving** the **clown** a gnome / a **gnome** to the clown*

The participants (48 children, 46 adults) were influenced by the prime structure: they produced more DO descriptions following DO primes than following PO primes, yielding a 12% priming effect overall. However, lexical boost effects varied between groups: adults showed a larger lexical boost for verb overlap (20%) than for noun overlap (2%), whereas children showed smaller lexical boosts but for both verb (7%) and noun overlap (10%). We will discuss the implications of these findings for models of syntactic priming in children and adults, with respect to possible influences of both task and structure on lexical boosts.

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A rabbit by any other name: Lexical alignment in preschoolers' dialogue

Laura Lindsay, University of Edinburgh, L.M.Lindsay@sms.ed.ac.uk
Zoe Hopkins, University of Edinburgh, zoe.hopkins@ed.ac.uk
Holly Branigan, University of Edinburgh, holly.branigan@ed.ac.uk

How do young children decide how to refer to objects? Many studies have shown a strong preference to use one word to refer to one concept (mutual exclusivity). But many objects have more than one possible name (e.g., *rabbit* vs. *bunny*). In adults, the choice between alternatives is sensitive to a partner's usage, with speakers tending to *align* (or *entrain*) on whichever alternative their partner has previously used [1]. These effects may reflect perspective-taking, lexical priming, or social affiliative mechanisms. In three experiments, we examined whether 3-4-year-olds' referential production is flexible, whether it is sensitive to a partner's usage, and the nature of the mechanisms that might underlie such alignment.

Participants played a picture-naming game with an adult. Experimental items had two alternative names. Pre-tests established that children knew and understood both names, but had a strong preference for one alternative. On experimental trials, children named an object previously named by the adult. We manipulated the name that the adult used (favoured vs. disfavoured), and examined children's likelihood of producing the disfavoured name. In Exp 1 (n=24), the child named the same picture as the adult. In Exp 2 (n=22), they named a different picture of the same object (e.g., a different rabbit). Exp 3 (n=18) replicated Exp 2, except children first named all objects before the game. In each experiment, half the children saw a video depicting 3rd party ostracism and half saw a neutral video before playing the game.

In all three experiments, children were more likely to use the disfavoured name (e.g., *bunny*) if the adult had previously used the disfavoured name than the favoured name (*rabbit*; E1: .63 vs .06; $p < .001$; E2: .59 vs .09; $p < .001$; E3: .39 vs .03; $p < .001$). This tendency was reduced when children had already named the object (with the favoured name) before the game (E2 vs E3: $p < .05$). In E1, children were less likely to align after viewing the ostracism video than neutral video (.55 vs .72; $p < .05$). In E2 and 3, they produced numerically more aligned responses after the ostracism than neutral video, but this difference was not significant (E2: .65 vs. .53; E3: .45 vs .33; $ps > .1$).

Our experiments show that 3-4 year old children's referential choices are flexible, and sensitive to their partner's previous usage. Children aligned with their partner's precedent even when this meant overcoming their strong default preference, and even – though to a lesser extent – when it violated their own precedent. These results converge with previous adult findings [1,2], and suggest preschoolers' referential choices are underpinned by psycholinguistic mechanisms involving perspective-taking and/or lexical priming. However, we found no evidence that they imitate a partner's language in order to affiliate with them, in contrast to non-linguistic imitation [3].

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Modeling the Role of Predictive vs. Recognition-based Processing in Acquisition

Stewart M. McCauley (Univ. of Liverpool) & Morten H. Christiansen (Cornell Univ.)

A key problem for language acquisition research is to uncover the mechanisms by which children discover the basic units of language. Substantial computational modeling work has focused on how children segment fluent speech into words, but less work has addressed the problem at the syntactic level. Recent behavioral work has shown that multiword units play an important role in syntax acquisition (cf. Arnon & Christiansen, *TopiCS in press*). We report results from computational modeling of children's discovery of multiword units, comparing two approaches previously used for word segmentation — prediction-based and recognition-based learning — with a new model, the Chunk-Based Learner (CBL), that incorporates both prediction and recognition.

In recent decades, "chunking" models have increased the tensions in the literature between recognition-based processing and statistically-based processing utilizing transitional probabilities (TPs; e.g., Saffran et al., *Scienc*e 1996). Despite the absence of predictive processing and lack of conditional probability calculation, chunking models can exhibit sensitivity to TPs in both directions (e.g., PARSER; Perruchet & Vinter, *J*ML 1998). Indeed, chunking models may offer a better fit to adult artificial language learning performance than do prediction-based models (e.g., Hamrick, *Lang. Learn*. 2014). However, such models have not been evaluated on naturalistic corpora, where purely prediction-based models (such as trigram models) have met with considerable success.

The CBL model, by contrast, combines prediction- and recognition-based processing. CBL learns from corpora of child-directed speech, in a purely incremental fashion, through on-line learning of simple statistics in the form of TPs. The model uses peaks and dips in TP to gradually build up an inventory of chunks consisting of one or more words, which unites recognition-based aspects of comprehension and production within a single framework. The model chunks words together on-line, incrementally building an item-based "shallow parse" as each incoming utterance unfolds. The model's phrase segmentation abilities are scored against a state-of-the-art shallow parser.

The CBL model outperforms a purely recognition-based model (PARSER) as well as purely prediction-based trigram models on this shallow parsing (phrase segmentation) task. We examine the F-Score (harmonic mean of accuracy and completeness) across 43 single-child English corpora (CBL: 75.4; PARSER: 66.1; Trigram model: 65.9; ANOVA [$F(2,82)=643.3$, $p<0.0001$]), with post-hoc analyses confirming stronger performance for CBL. The same pattern of results is found with 15 French corpora (mean F-scores for CBL: 71.6; PARSER: 64.4; Trigram model: 59.0; [$F(2,26)=214.6$, $p<0.0001$]) and 22 German corpora (mean F-scores for CBL: 75.7; PARSER: 73.4; Trigram model: 67.4; [$F(2,40)=69.43$, $p<0.0001$]).

Importantly, the multiword units learned by the model can support aspects of production: when CBL encounters an utterance produced by the target child of a corpus, it attempts to produce its own utterance based on a corresponding scrambled bag-of-words, relying solely on chunks and statistics learned previously. The model can successfully produce over half of the multiword child utterances across a typologically diverse array of 29 languages from the CHILDES database. Moreover, when the model's prediction mechanism is extended to allow generalization over multiword chunks, it can produce lexical frames (e.g., *I'm going to* ____) which improve production performance by as much as 17%. Thus, CBL reconciles prediction- and recognition-based processing, capturing specific aspects of language learning by combining the best elements of both approaches.

Statistical learning and cognitive constraints on rule induction. An entropy model

Silvia Rădulescu (Utrecht University), Efi Giannopoulou (Utrecht University), Sergey Avrutin (Utrecht University), & Frank Wijnen (Utrecht University)
S.Radulescu@uu.nl

What triggers the inductive leap from memorizing items and statistical regularities to inferring abstract rules? We propose an innovative information-theoretic model for both learning statistical regularities and generalizing to new input. Our entropy model predicts that *rule induction is an encoding mechanism triggered by the discrepancy between input complexity (entropy) and the limited encoding power of the human brain (channel capacity)*.

While traditional cognitive psychology claimed that rule learning relies on encoding of linguistic items as abstract categories (Marcus et al, 1999), as opposed to learning statistical regularities between specific items (Safran et al., 1996), recent views converge on the hypothesis that it is one mechanism – *statistical learning* – that underlies both item-bound learning and rule induction (Aslin & Newport, 2012; 2014; Frost & Monaghan, 2016). However, it is still not clear how a single mechanism outputs two qualitatively different forms of encoding – item-bound and category-based generalization, and what factors trigger the inductive leap from one to the other.

In our model, less *input complexity (entropy)* facilitates memorization of items and item-bound generalization, while a higher complexity exceeding *channel capacity* drives category-based generalization.

In two artificial grammar experiments, we exposed adults to a 3-syllable XXY artificial grammar to probe the *effect of input complexity* on rule induction. We designed six experimental conditions with different degrees of input complexity and we used entropy to measure the complexity. Results showed that when input complexity increases, the tendency to infer abstract rules increases gradually (Fig.1)

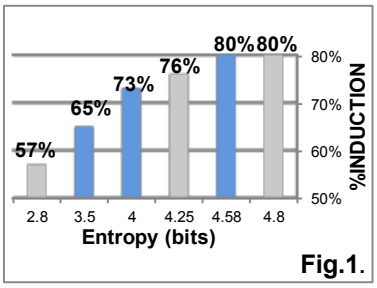


Fig.1.

Previous studies suggested certain cognitive constraints on rule induction (Newport, 1999; Hudson Kam & Newport, 2005; 2009). According to our entropy model, the limited encoding power of the human brain (*channel capacity*) is modulated by incidental memory capacity and a general pattern recognition capacity. We ran another experiment with adults to investigate the *effect of individual differences in channel capacity* on rule induction. Participants were first tested on rule induction when exposed to a medium input entropy, as designed previously (4.25 bits). Individual memory and pattern recognition capacity were measured in three independent tests. A test measured (unintentional) incidental memorization, another test measured memory span (standard forward digit span), and another test measured visual pattern recognition (Standard Raven's Matrices). Results showed that the lower the incidental memorization capacity, the higher the tendency towards category-based generalizations. Conversely, the higher the visual pattern-recognition capacity, the more likely participants were to make category-based generalizations.

We are currently running another experiment in which participants' channel capacity is overloaded in a simultaneous dual task, while being exposed to the low entropy grammar (2.8 bits). Results are expected to show participants are more likely to infer abstract rules when overloading their channel capacity, even if they are exposed to a low entropy grammar.

The Emergence and Role of Explicit Knowledge in Implicit Statistical Learning

Jelena Mirković[1] & Emma Hayiou-Thomas[2]
[1]York St John University, [2]University of York

Statistical learning of linguistic regularities can be achieved without any explicit awareness, and is thought to be underpinned by implicit memory systems. However, recent studies have shown that explicit knowledge can emerge in the course of learning and can influence performance in statistical learning tasks (e.g., Batterink et al. 2015). Understanding the contributions of implicit and explicit learning and memory systems to statistical learning is key to uncovering the cognitive and neural mechanisms underlying language learning. This is particularly important as the two memory systems have different developmental trajectories and thus the relative contributions of each system may change across the life span.

Here we present three studies exploring the emergence and role of explicit knowledge in statistical learning in adults and 10-year-old children using a task that draws on statistical regularities across multiple domains: phonological, distributional, and semantic. This type of multi-dimensional regularities is central to grammatical category learning.

Participants were trained on an artificial noun system consisting of two classes modeled on grammatical gender. The nouns in one class were preceded by a 'determiner' *tib* and had the 'suffix' *eem* (e.g., *tib lekeem*), and in the other by the determiner '*ked* 'and with the 'suffix' *ool* (e.g., *ked jorool*). The *tib…eem* words were paired with pictures of familiar animals, and the *ked…ool* words with pictures of familiar objects. Participants were trained using an implicit word learning task. We manipulated the number of exemplars in each noun class (Study 1 vs. Study 2), and the training method (comprehension only (Study 2) vs. comprehension + production (Study 3)). Participants were tested in a series of tasks assessing both vocabulary and grammar learning. The grammar learning tasks were specifically focused on the ability to generalize different sets of regularities (determiner + suffix, no semantics; determiner + suffix + semantics; suffix + semantics) to new exemplars. In all three studies we also measured explicit knowledge of the different regularities.

Across all three studies, adults outperformed children on the tests of vocabulary knowledge, with both groups learning significantly above chance. Adults generalized the 'grammatical' regularities when the new exemplars incorporated all three regularities (determiner + suffix + semantics), regardless of the method of training and the number of exemplars. Children, however, only generalized in this condition after a training regime including language production and a larger number of exemplars in each class. Adults generalized the regularities involving the suffix only with a larger number of exemplars, unlike the children who did not show evidence of this type of generalization. Crucially, across both age groups, explicit knowledge of the regularities was correlated only with a subset of the generalization tasks.

Together, our findings suggest that explicit knowledge emerges in the course of statistical learning of multiple linguistic regularities, and it influences learning, in both adults and children. However, implicit knowledge also critically shapes performance, and explicit awareness is not necessary for successful generalization. We will discuss the implications of these findings for models of language learning.

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Complexity matters only when it matters: Pronominal object and event reference rapidly access different aspects of situation models

Eva Wittenberg (UCSD), Shota Momma (UCSD), Elsi Kaiser (USC), Jeremy Skipper (UCL)

Pronoun resolution has long been central to psycholinguistics, but mostly focused on personal pronouns (*he/she*). However, much of linguistic reference is to events and objects, in English often using the demonstrative pronouns *that/this* and the pronoun *it*, respectively (e.g., Çokal et al., 2016). We propose that event and object reference tap into fundamentally different processes: Object reference, much like person reference, is a "pointer" to an event participant; but event reference re-accesses a multidimensional situation model (e.g., Cornish, 2008). We present evidence for this hypothesis from two studies: (i) Both *it* and *that/this* are influenced by superficial properties of the linguistic context, such as lexical frequency (Exp.1), but (ii) *that* is more sensitive to representational properties of events, such as complexity, because *that* re-accesses the whole situation model, as opposed to *it*, which only points to an event participant (Exp.2).

Exp.1 tests the hypothesis that lexical frequency of the context influences both *it* and *that*. We created 40 sets like (1), manipulating pronoun (*that/it*) and word frequency (*forest*=high, *jungle*=low frequency), using synonyms or semantically closely related nouns.

(1) *The hikers explored the forest/jungle. That/It was really adventurous.*

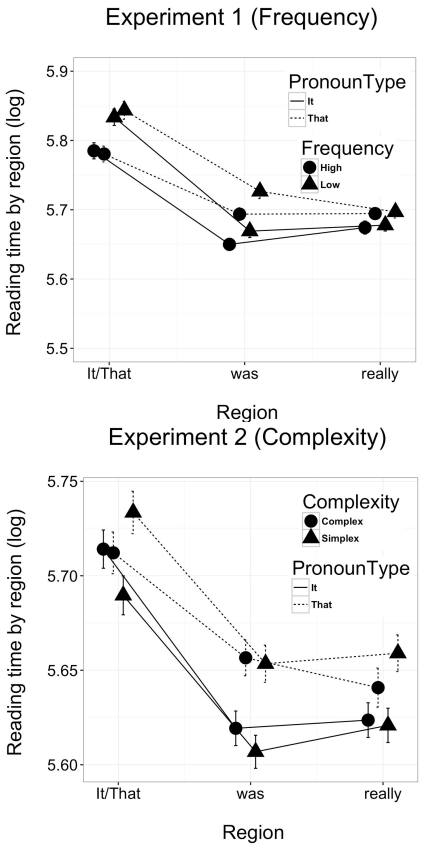
(N=88) read stimuli (+40 fillers) in a self-paced reading experiment. RTs to the final adjective (event-biasing, e.g., *adventurous*, or object-biasing, e.g., *vast*) confirm that *it* indeed was interpreted as referring to objects and *that,* to events. Fig.1 shows that both *it* and *that* were read faster after more frequent object nouns (main effect of frequency, β=.05; $|t|$=2.31; p<.05), with no change in this pattern over time. Thus, both kinds of pronouns are sensitive to frequency.

Exp.2: The same sets were used (N=76), but manipulating event complexity instead of frequency (exploring event=complex, entering event=simple subevent of exploring). We correlated event complexity and verbs' lexical frequency, such that verbs describing more complex events were less frequent.

(2) *The hikers explored/entered the forest.*
That/It was really adventurous.

Here, we expected an interaction of complexity/frequency and pronoun, with *it* being read *slower* after a low-freq/ complex-event verb; and *that* being read *faster* after a low-freq/complex-event verb, following evidence that more complex representations result in faster re-access (Hofmeister, 2011). Fig.2 shows marginally slower overall RTs for *that* compared to *it*, presumably due to word length. Crucially, we also found the predicted interaction (pronoun *x* complexity, β=.05; $|t|$=2.45; p<.05), even when verb frequency is separately included as a predictor (β=.05; $|t|$=2.44; p<.05).

These results show that demonstratives are sensitive to event complexity. This is compatible with the idea that *that* re-accesses the whole situation model, but *it*, only an event participant; and the parser rapidly accesses only those structures that are relevant for a given pronoun.



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Listeners rapidly use unexpected information to update their predictions

Wing-Yee Chow & Di Chen
University College London

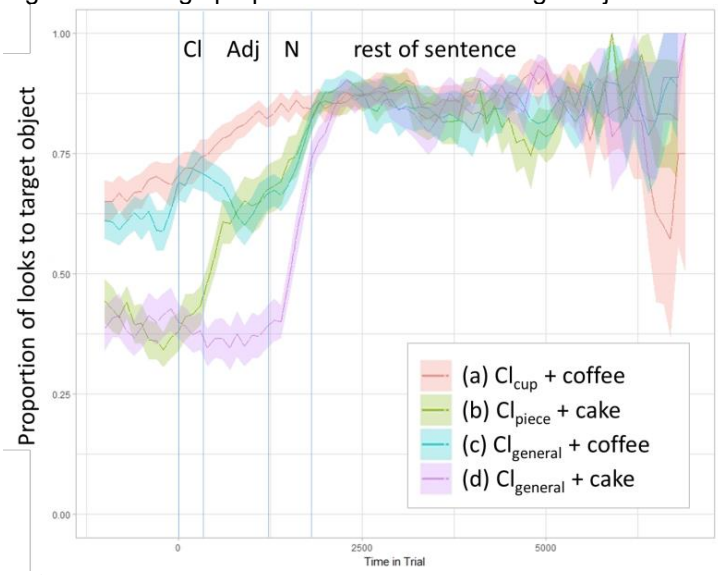
Comprehenders can incorporate rich contextual information to predict upcoming input on the fly [1-2], and cues that conflict with their predictions are quickly detected [3-4]. However, to date little is known about how such information is dealt with in real time. For example, do listeners use unexpected information to revise their existing predictions? Here we took advantage of the rich classifier system in Mandarin Chinese to examine whether and how comprehenders update their noun prediction upon encountering an unexpected classifier. Since Mandarin has over 100 classifiers and different classifiers are associated with nouns with different semantic-conceptual properties like shapes and functions (e.g., 'zhi' for pens and tree branches, 'ding' for hats and crowns), an unexpected classifier can not only disconfirm the listeners' predictions about an upcoming noun, but it can also be very informative for making new predictions. Listeners' eye-movement records suggest that they can quickly use prediction-mismatching classifiers to revise their predictions.

We tracked participants' eye-movements as they listened to Chinese sentences with an English equivalent like (1), where the target noun is preceded by a classifier and an adjective. Crucially, the classifier was either compatible with the most expected noun *coffee* (e.g., 'bei'), or incompatible with *coffee* but indicative of another contextually suitable noun like *cake* (e.g., 'jian'). A general classifier (e.g., 'ge', 'xie') that is compatible with both nouns (and therefore is uninformative) was used in the control conditions.

(1) In preparation for his long study session today, John went to Starbucks this morning and bought a {Cl_{cup} / Cl_{piece} / $Cl_{general}$} of good-tasting {coffee / cake}…

Results (n=24) showed that listeners were initially more likely to look at the expected object (coffee). Upon encountering an unexpected classifier, they were more likely to redirect their eye gaze to the unexpected object (cake) prior to noun onset (b vs. d; Fig 1). These results extend previous evidence for listeners' sensitivity to prediction errors and show that they can also use unexpected information to update their predictions rapidly.

Figure 1. Average proportion of looks to the target object time-locked to classifier onset.



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The psychological reality of name agreement in picture naming

Evangelia Balatsou (Bangor University, UK), Dr Simon Fischer-Baum (Rice University, TX), Dr Gary M. Oppenheim (Bangor University, UK/ Rice University, TX)
e.balatsou@bangor.ac.uk

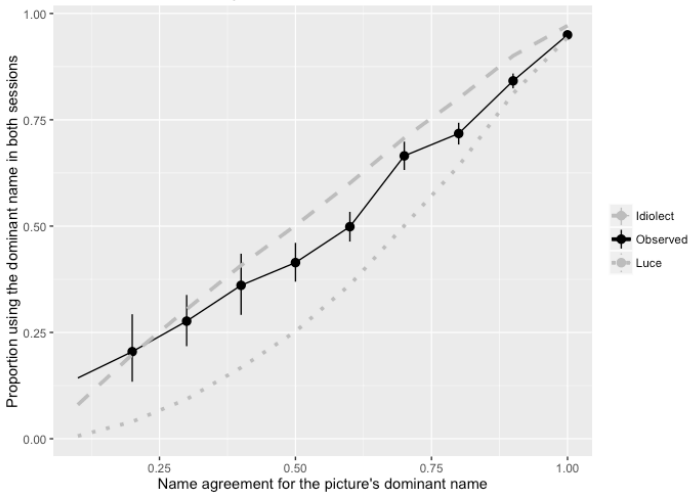
Given a picture that can be appropriately named as either *couch* or *sofa*, how does an individual speaker decide between these options? According to the dominant assumption in the literature, they stochastically select a single name in proportion to the probabilities observed for a larger population, e.g. in timed picture naming norms. That is, researchers assume that such population-level *name agreement* indexes a decision process that takes place within the mind of each individual: if the population is split between two similarly likely names, then an individual will independently sample from the population's responses each time they name the picture, where each word selection can be assumed to follow a stochastic function like the Luce choice rule ($\alpha/\Sigma(\alpha)$). For instance, if norms show that 50% of speakers name the picture as *couch*, then each time a person tries to name the picture, they should have a 50% chance of selecting *couch*. An alternative, however, may be that picture naming norms instead reflect population-level sampling of more stable individual preferences (i.e. idiolects). For instance, if we assume that production basically functions according to a one-concept-one-word rule, then an individual *couch* speaker may never actually consider sofa as an alternative.

One way to distinguish between these possibilities – and assess the psychological reality of name agreement – is simply to re-norm pictures with the same individuals (analogous to a multiple-baseline approach in patient testing). According to the Luce-choice-inspired account, whether an individual uses a picture's dominant name (*couch*) in the second norming session should solely depend on its population-level name agreement, regardless of what name that person actually selected in their first session. According to the alternative 'idiolect' account, though, a person should simply repeat their Session 1 response in Session 2, regardless of that picture's population-level name agreement.

Thus, we collected timed naming norms for the 525 black-and-white line drawings of the IPNP (Bates et al, 2003) from the same 25 native British English speakers twice, 1-2 weeks apart. Methods within each session followed standardised IPNP procedures.

As illustrated in Figure 1, logistic mixed-effects regressions modelling the likelihood of producing a picture's dominant name in Session 2 reveal independent contributions of 1.) population-level name agreement, from our previous norms, and 2.) individuals' own productions in Session 1. This is the first direct demonstration that picture name agreement has some psychological validity, but also reveals that it does not directly index within-subject lexical competition as previously assumed.

Figure 1. The observed likelihood of a person using the same dominant name in both sessions falls between predictions from the stable idiolect account and the independent Luce choice account.



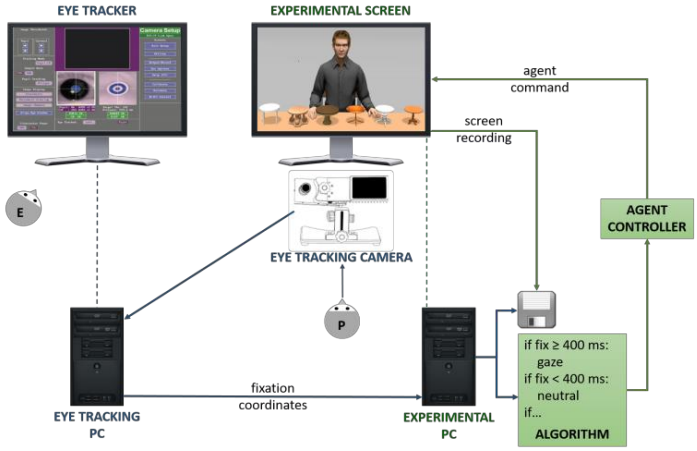
References:
Bates, E., *et al.* (2003). Timed picture naming in seven languages. *Psychonomic bulletin & review*, *10*(2), 344-380.

Simulating listener gaze and evaluating its effect on human speakers

Laura Frädrich[1], Fabrizio Nunnari[1], Alexis Heloir[1,2] & Maria Staudte[1]
[1]Saarland University, [2]LAMIH UMR CNRS 8201
laura.fraedrich@gmx.de

Previous research has shown that listeners follow the speaker's gaze (Staudte, M., Crocker, M., Heloir, A., & Kipp, M., 2014). However, the reciprocal effect, i.e. the impact of listeners' gaze on the speaker, is largely unknown. We conducted an explorative, truly interactive eye-tracking study, exploiting speakers' fixation data both as diagnostic tool and as input data for a gaze-following mechanism employed in a virtual agent to simulate listener gaze and joint attention. We compared participants' performance in scenarios with and without such a gaze-following behaviour ("gaze-follow" vs "no gaze" conditions).

While being eye-tracked, 25 participants verbally described three out of six similar objects placed in front of the agent until they thought that the agent could identify the described object (indicated by the word "done"). In "gaze-follow", the agent turned its head to the objects currently fixated by the participant, after going through some filtering to avoid abrupt and unnatural behaviour. In "no gaze", the agent maintained gaze straight ahead. Fixations on the avatar's head elicited verbal backchannels as well as affirmative head nods in both conditions. Each participant performed the procedure blocked, three times in each condition, with sets of objects pertaining to six different categories (e.g. cars or tables). Thus, nine objects were described in each condition.



Experimental set-up, illustrating the data flow.

Fixation frequencies and durations on critical areas and utterance length in terms of words and seconds were analysed using linear mixed-effects models and logistic regression with a binomial link function. The fixation data were normalised by description durations to obtain comparable proportions of the fixation duration and frequency by a given time unit. Additionally, subjective ratings of the agent's intelligence and the impression of being understood were collected via questionnaires after each block.

In "gaze-follow", the word count per description decreased by 33.5% ($p = 0.021$) and fixation duration on the described objects by 10% ($p = 0.075$) compared to "no gaze". Fixation duration on the avatar and background together increased instead ($p = 0.069$).

Our findings suggest that our rather simple gaze-following mechanism simulates listener gaze behaviour and joint attention, at least to some extent, and that it evokes an adaptation of the speaker's behaviour. Observing fewer words in the same amount of time could indicate that speakers might either try more carefully to produce a referential description, or that they are more involved yet distracted by the interactive aspect of the task. Increased looks to the agent and the background, however, seem to support the latter. More controlled follow-up studies can now look closer into the impact of listener gaze and joint attention on the spoken utterances and hopefully shed more light on this under-researched topic.

Culturally evolving complex constructions in artificial sign languages

Yasamin Motamedi[1,2], Marieke Schouwstra[1], Jennifer Culbertson[1], Kenny Smith[1] and Simon Kirby[1]
[1]Centre for Language Evolution, the University of Edinburgh
[2]Experimental Psychology, University College London

Previous experimental research in the cultural evolution of language has demonstrated the emergence of systematically structured signals, driven by the mechanisms of interaction between language users and the transmission of a language to new learners (Kirby et al., 2015; Carr et al., 2016). However, most of these studies have focussed on simple meanings that reflect one or two aesthetic dimensions of an object (e.g. shape and colour).

We present an experiment that expands the cultural evolutionary framework to complex constructions, asking participants to denote agents in complex events. Furthermore, we link our experimental work to natural language data, drawing from the only current evidence of language creation: emerging sign languages that have evolved over the past century. Hearing participants are asked to communicate complex events using only gesture, following the silent gesture paradigm (Goldin-Meadow et al., 2008). This is implemented within a cultural evolutionary framework; pairs of participants learn gestures produced by a previous participant, before communicating with each other in a testing stage, combining models of interaction within a community, and transmission to new generations of a community (Kirby et al., 2015).

Participants in the experiment were presented with pairs of English sentences to communicate to their partner. Sentences contained one or both animate participants, *Hannah* or *Sarah*, who interacted in complex events. Sentence pairs were nested in blocks, providing a discourse structure with which participants could track sentence arguments. Participants in generation 1 of the transmission chains innovated gestures for the target sentences. Participants in generations 2-5 were first trained on gestures produced by a previous participant, and then, in a testing stage, took turns to communicate with each other about the same events, both producing and interpreting gestures.

Our results find three main strategies for distinguishing between sentence arguments: one based on the hand-form of particular gestures, termed the lexical strategy, and two others that use spatial contrasts to systematically denote similarities and differences between agents in target sentences. Over generations in the experiment, participants converge on a particular strategy, where it becomes further systematised. The strategies participants use reflect tools in natural sign languages and mirror findings from emerging sign languages on the evolution of grammatical spatial devices. In particular, they demonstrate how iconicity and reliance on the representational affordances of the gesturer's own body interfere with the systematisation of a linguistic tool used to denote who does what to whom.

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Lexical access in cochlear implant users

Leanne Nagels[1,2], Roelien Bastiaanse[2], Deniz Başkent[1,], and Anita Wagner[1]
[1] Department of Otorhinolaryngology, University Medical Center Groningen
[2] Center for Language and Cognition Groningen, University of Groningen

Lexical competition is resolved rapidly by normal-hearing (NH) listeners in optimal conditions. In noisy environments, listeners rely more on supportive linguistic cues, such as contextual and lexical factors (e.g. neighborhood density) (Mattys & Wiget, 2011). It is yet unclear how cochlear implant (CI) users, who process a degraded speech input signal, make use of supportive linguistic cues. The present study investigated how CI users integrate contextual and lexical information within the time-course of lexical access, and how individual differences in the ability to timely integrate contextual information are related to the reliance on lexical information.

Fifteen postlingually deaf CI users and fourteen age- and gender-matched NH listeners were tested. Eye-tracking was used to measure the effect of verb-based thematic constraints on lexical competition (Dahan & Tanenhaus, 2004; Wagner et al., 2016). Listeners were presented with sentences, in which the target (e.g. baby) was either preceded (context condition) or followed (neutral condition) by the main verb (e.g. to crawl). Drawings of the target, a phonological competitor (beker), a semantic competitor (worm), and an unrelated distractor were concurrently displayed. Gaze fixations were analyzed using growth curve analysis. Furthermore, an auditory lexical-decision task was conducted to study the effect of lexical factors, namely lexicality, frequency, neighborhood density (ND), and age-of-acquisition, on lexical access. Accuracy scores and reaction times (RTs) were analyzed using linear-mixed effects models. Finally, fixation time-curves per participant were correlated with individual's sensitivity to discriminate words from nonwords measured in d'.

The results demonstrate that the time course of lexical competition is generally delayed in CI users (Fig. 1). Furthermore, significant interactions of group and lexicality were found for accuracy scores and RTs. CI users had longer RTs and lower accuracy scores for nonwords than words relative to NH listeners. CI users also had longer RTs for low ND nonwords than high ND nonwords while the opposite pattern is commonly found for NH listeners. Finally, individual variation in the time course of lexical competition among CI users was related to their sensitivity to word-nonword differences (d's). CI users' certainty in rejecting nonwords as words reflects individual differences in the ability to quickly integrate contextual information to resolve lexical competition.

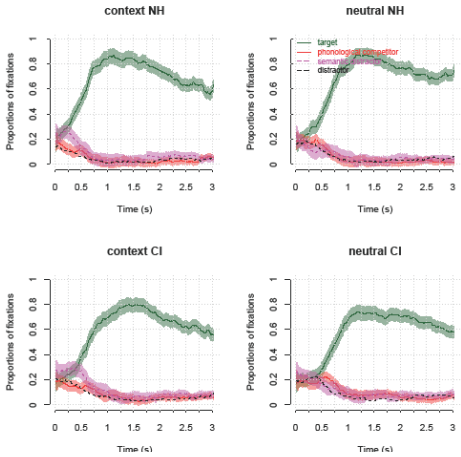


Fig. 1 Proportion of gaze fixations

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The robustness of lexical encoding in a second language is related to phonetic flexibility

Miquel Llompart and *Eva Reinisch*
Ludwig Maximilian University Munich, Germany

Speech perception is characterized by the interaction between the need for robust sound categories in stable lexical representations and the ability to flexibly adjust these categories to adapt to variation coming from manifold sources. Second language (L2) learning is a valuable testing ground to examine this tug-of-war between stability and flexibility because it entails the establishment of new sound categories. Such new categories cause great difficulties for learners if they mismatch the categories of the L1 (e.g., differentiating English /æ/ and /ɛ/ for native speakers of German [1]). However, for successful communication in the L2, learners should perceptually differentiate between these difficult sounds. That is, they need a certain amount of stability in the new L2 categories not only at the phonetic level but also at the lexical level in order to distinguish between L2 words (e.g., *bad* vs. *bed*). The question that follows from this is how this need for stability relates to the need for flexibility to cope with variation. In the present study, we asked how two learner groups with supposedly poorly defined vs. more robust L2 lexical representations perform on a distributional learning task where they are tested on their flexibility in adjusting phonetic category boundaries in response to probabilistic input.

In a two-stage experiment, 27 medium-proficiency German learners of English performed a lexical decision task containing /ɛ/-/æ/ mispronunciations (e.g., **lamon*, **dregon* for *lemon* and *dragon*; see [2]) and a distributional learning task during which they categorized an 11-step continuum going from *bet* to *bat*. Before each of two blocks of categorization, participants were asked to listen to tokens from the continuum sampling distributions that first should shift their perceptual boundary towards /æ/ and then back towards /ɛ/. Participants were split according to their performance on the lexical decision task. The nine participants who managed to reject most mispronounced words as nonwords were considered the group with strong lexical representations. The nine worst performers (i.e., who accepted the most mispronounced words as real words) were considered the weak-representations group. Results showed that only the weak-representations group shifted their phonetic category boundary in response to the input presented for distributional learning; good performers were consistent in their categorization regardless of the distribution they had been exposed to.

These results suggest that a more robust lexical encoding of difficult sound contrasts in L2 words is related to having more rigid categories for these contrasts at the phonetic level. That is, during the process of mastering a difficult L2 contrast, listeners may first have to establish rigid phonetic categories to facilitate the reliable mapping of the newly-established contrast to the lexicon. Enhanced flexibility at the phonetic level, in contrast, may complicate the task of associating these categories to individual lexical items.

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Crosslinguistic perceptual similarity and asymmetric lexical competition in L2 spoken-word recognition

Juli Cebrian, Universitat Autònoma de Barcelona
Joan Carles Mora, Universitat de Barcelona

When processing speech in a second or foreign language (L2), speakers appear to access both native and L2 lexicons (e.g. Marian & Spivey, 2003). L2 speakers also show within-L2 competition when processing perceptually confusable words (Weber & Cutler, 2004; Cutler, Weber & Otake, 2006; Escudero, Rayes-Harb & Mitterer, 2008). In fact, Weber and Cutler (2004) found that Dutch learners of English, who tend to confuse English /ɛ/ and /æ/, upon hearing the initial sounds in *panda,* fixated on both *panda* and *pencil*, but only on *pencil* with target word *pencil*. A similar asymmetry was observed with Japanese listeners in pairs involving English /l/ and /r/ (Cutler et al., 2006). The asymmetry was related to the presence of a dominant category in each confusable pair, and this dominant category was hypothesized to be the member in the pair with the highest degree of similarity to an L1 sound.

This study aimed to examine if L2 speakers display asymmetric mapping with L1-L2 single-category perceptual assimilations, and to explore the relationship between dominant category and perceptual closeness between L1 and L2 categories. Two groups of speakers participated in two eye-tracking experiments: 43 Catalan learners of English and 18 native English-speaking controls. The target sounds examined were English /i/-/ɪ/ and /æ/-/ʌ/, with respect to the perceptually close Catalan /i/ and /a/, respectively. The first experiment investigated within-L2 competition, and tested if L2 learners show an asymmetry when presented with critical trials containing two members of a confusable pair (e.g., *sheep-ships, hut-hats*). Control trials contained no phonological competitor, or included overlapping but non-confusable words. The second experiment evaluated between-language competition: competitors in this case involved interlingual homophones, e.g., English *pillow*, Catalan *pila* (“battery”).

Results of the first experiment showed that lexical access was slowed down by the presence of a competitor and L2 speakers took longer to disambiguate between target and competitor than native speakers did. Competition from perceptually close words in confusable pairs (/i:/-/ɪ/, /æ/-/ʌ/) was greater for L2 speakers than for native speakers. Importantly, for L2 speakers competition was greatest with targets /ɪ/ and /ʌ/, paired with competitors /i:/ and /æ/ (respectively), than in the reverse situation, showing that /i:/ and /æ/ patterned as the dominant category. The second experiment showed that the vowels that emerged as the dominant categories in experiment 1 tended to suffer greater competition from the interlingual homophones (L1 competitor) than the non-dominant categories. This outcome supports the view that asymetrical lexical access in L2 may indeed be influenced by L1-L2 perceptual similarity. The results are discussed in terms of the possible relationship between L1-L2 lexical competition and L1-L2 phonetic overlap.

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Cross-modal Bilingual Activation in English & American Sign Language Bilinguals: The role of language experience

Robin L. Thompson and Clifton Langdon+*
**School of Psychology, University of Birmingham, UK,*
+ PhD Program in Educational Neuroscience, Gallaudet University

When bilinguals hear a word in one language, they activate the corresponding word in the second spoken language [1]. Spoken language bilinguals also co-activate words *across* modalities when reading (e.g. English & Japanese bilinguals; [2]). Furthermore, when deaf signers (fluent in written English & American Sign Language, ASL) read English, they activate semantically equivalent words in ASL [3]. Here, we use a lexical decision task (LDT: decide whether presented words are real or not) to investigate whether language processing in bimodal bilinguals is only unidirectional from print to ASL, or if cross-modal activation of corresponding word equivalents and their phonological representation is bi-directional. Specifically, we ask whether phonological priming of English words occurs during an *ASL-only* LDT task when the English translation equivalents are phonologically related. We also examine the role of language experience (i.e., age of ASL exposure, AoE) and acoustic experience (deaf or hearing participants).

Methods: 62 participants fluent in ASL and English took part. 34 were early signers (20 deaf, 14 hearing AoE<4); 28 participants were late signers (13 deaf, 15 hearing; AoE >7yr old). Participants were presented with 396 ASL sign pairs (1/2 "yes" answers). Critical target signs (all 'yes' answers; n=50) were repeated twice (with order of presentation counter-balanced); once by an unrelated sign and once by a sign with a phonologically related English translation equivalent but was unrelated in ASL (e.g. ROCK & ROCKET).

Results: Analyses tested for effects of prime type (English prime or unrelated prime) and participant group (both by age of sign onset and hearing status). Analyses employed mixed-effects models with crossed random effects for subjects and items, fit using restricted maximum likelihood estimation. Hearing status did not improve the model and was removed. A main effect of PrimeType was found (p=.035) which was further qualified by a PrimeType by Group interaction (p=.007). The interaction reveals that, while all participants exhibited a priming effect, for late signers English-related priming inhibited responses, while alternatively for early signers English priming facilitated responses.

Conclusion: The main effect of English priming via ASL words for early hearing and deaf signers indicates that for skilled signers, spoken and signed lexicons are linked similarly to speech-speech bilinguals. Thus, our results support a somewhat remarkable bilingual activation based on phonological form of the second language, despite modality differences and a lack of overlapping phonology between signed and spoken languages. Furthermore, while late signers showed an English priming effect, they exhibited a unique pattern of interference, indicating atypical processing resulting from delayed language acquisition (ASL AoE >7yrs) similar to other findings that phonological processing effort is increased for late sign learners [4].

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Bilingualism is associated with better statistical learning

LUCA ONNIS, WIN EE CHUN
Nanyang Technological University

Several studies have now linked individual variance on statistical learning (SL) tasks with individual variance in tasks of natural language learning and processing, thus suggesting that the two abilities are related. Here we asked whether SL is linked to language use and experience in a bi-directional way by examining effects in the opposite direction. That is, if individual differences in statistical learning are predictive of language outcomes, can specific types of language experience in turn heighten sensitivity to extract patterned regularities, making individuals with certain types of experiential histories better learners?

A natural test of this condition is found among bilinguals. Different languages exhibit idiosyncratic statistical properties at different levels of analysis, from the number and distribution of sounds in and across words, to morpheme and word predictability patterns. We reasoned that to succeed in bilingual learning, bilinguals must necessarily learn and keep separate distinct sets of statistical regularities, and in doing so their statistical learning skills might be sharpened. Using multiple languages may confer distinct social and cognitive advantages, such as sustained attention and switching between tasks effectively. However, there is relatively little research on whether bilingualism confers an advantage in implicit statistical learning. We hypothesized that the lifetime exposure to two different sets of linguistic regularities may have a positive influence on implicit language learning of *novel* statistical regularities. We tested young adults (n=55) of varying degrees of bilingual experience on a challenging artificial grammar learning task, modeled and adapted from Conway and Christiansen (2006). The task involved simultaneous learning of two miniature languages containing two independent sets of statistical regularities. Previous research suggests that this is a particularly challenging task.

Following a 12-min training session we obtained accuracy scores on a grammaticality test for each language as a measure of learning. We found that participants learned each grammar significantly better than chance and both grammars equally well. In addition and crucially, a gradient bilingual dominance index obtained from the Bilingual Language Profile questionnaire (https://sites.la.utexas.edu/bilingual/) predicted accuracy scores for both artificial grammars in a generalized linear model.

The study of bilingualism and its effects on cognition has largely focused on executive function skills - which include abilities to switch between tasks or attend to multiple stimuli - and mostly neglected *learning* abilities. This study partially fills this gap by proposing that bilinguals may exhibit heightened statistical learning abilities, thus extending the scope of the bilingual advantage. Our findings also contribute to qualify the nature of the advantage as a graded one. We adopted an individual differences approach and treated bilinguals as a heterogeneous group, rather than as a homogeneous group contrasted to monolinguals. The latter approach is frequent, but may obfuscate gradual dimensions of bilingualism that in turn reflect different cognitive sensitivities. Together with previous studies documenting statistical learning and language, a broader picture is emerging: not only is statistical learning associated with the acquisition and processing of language, but also specific experiences with language - here bilingualism - may modify individuals' statistical learning abilities.

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Does the result justify the means?
The representation of resultative events in Mandarin and Spanish

Miguel Santín (University of Groningen), Angeliek van Hout (University of Groningen),
Monique Flecken (Max Planck Institute for Psycholinguistics)

Languages differ as to how they verbally encode resultative events (i.e. events in which actions are directed towards the achievement of a result, e.g. “burn the paper”). Mandarin and Spanish differ prominently: Mandarin has resultative verb compounds (RVCs) separately encoding manner of action in the main verb and result in a resultative morpheme: *shao-hui le zhi* (burn-destroy PERF paper) (Chen, 2016). Spanish, as a result-oriented language (Slobin, 1996), uses main verbs which encode either manner of action: *quemó el papel* (burned the paper), or result of events: *destruyó el papel* (destroyed the paper) (García del Real, 2015). We compared Mandarin and Spanish native speakers in two experiments (Verbal & Non-verbal) to investigate to what extent habituation to the use of different verbal structures influences the representation of resultative events in memory.

Participants saw 24 short movies: 12 events progressing towards a clear result, 12 without such a result. The events were shown in different stages of completion: either as ceased (action came to an end) or as ongoing (action was still in progress at the end). In the event encoding stage of the Verbal experiment, participants described the events in their native language (Spanish n=22; Mandarin n=21). In the encoding stage of the Non-Verbal experiment participants had to detect event repetition (a screenshot appeared and participants indicated whether the image matched the last video they had seen) (Spanish n=20; Mandarin n=21). After the encoding task, a surprise recall task was carried out: participants were shown screenshots of the videos’ final frames, depicting events either as ceased or ongoing, and they had to judge, by pressing a button, whether the screenshots showed the actual ending of the videos watched during the encoding phase.

In the production data Mandarin speakers distinguished the four types of movies, using RVC structures almost exclusively to describe *ceased resultative events* (60% of the cases), whereas Spanish speakers produced no specific patterns. Results of the memory tasks are shown for the two crucial conditions in Table 1. Overt verbalization of results by way of using RVCs boosted the memory of event endings in Mandarin speakers, supporting *thinking for speaking* (Slobin, 1996). In contrast, Spanish participants were equally good at remembering *ceased resultative events* in both encoding conditions with a similar accuracy as the Mandarin Verbal group. Given that Spanish is a result-oriented language (but Mandarin is not), the Spanish are more focused on the representation of result states of events. We argue that this supports *linguistic relativity*.

Table 1 Recall accuracy (%) of resultative events in the memory task of experiment 1 and 2

Condition per language group	Verbal experiment	Non-verbal experiment
Ceased resultative (Mandarin)	76.2%	60.3%
Ongoing resultative (Mandarin)	47.6%	50.8%
Ceased resultative (Spanish)	79.5%	72.5%
Ongoing resultative (Spanish)	58.3%	47.5%

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Missing-VP Effects in a Head-Final Language

Noyan Dokudan, Mehmet Yarkın Ergin, and Pavel Logačev
Boğaziçi University, Istanbul, Turkey

Nested structures usually cause great processing difficulty. Surprisingly, omitting one verb from such complex structures, as in (1), can sometimes ease processing, although doing so renders the sentence ungrammatical. This so-called *missing-VP effect* surfaces during faster reading of sentences with a missing verb (Gimenes et al., 2009; Vasisth et al. 2010; Frank et al., 2016). Such sentences are also perceived as equally or less complex (Gibson & Thomas, 1999; Gimenes et al., 2009), and are sometimes considered acceptable. (Häussler & Bader, 2015)

(1) [$_{S1}$The manuscript [$_{S2}$that the student [$_{S3}$who the catalog confused] ~~was studying]~~ was missing a page].

Häussler & Bader (2015) argue that an illusion of grammaticality occurs as a result of interference during cue-based retrieval. We propose an alternative account based on interference and theta-role assignment: In missing-VP versions of (1), NP_2 (*student*) is assigned a theta-role by *confused*, which sometimes results in the erroneous retrieval of NP_1 (*manuscript*) during the processing of the last VP. The resulting parse can cause an illusion of grammaticality, due to the fact that each NP has at least one theta-role.

Our hypothesis predicts that sentences with missing verbs are more likely to be judged as acceptable when the subject of that verb has received a theta-role from another source, such as a relative clause (RC) modifying it. To test this hypothesis, we conducted a speeded acceptability judgment experiment in Turkish (N=78) with sentences containing center-embedded complement clauses. All 48 experimental items had the structure of the example in (2). We manipulated two factors in a 2 x 3 design: Ungrammatical missing-verb sentences were derived from their grammatical counterparts by omitting the second embedded verb (V2; *listen to*). All subject nouns were either (i) modified by an RC (theta-assignment conditions), or (ii) modified by an adjective (control conditions with modification), or (iii) bare (simple control conditions). 52 filler sentences were designed to prevent noun- or verb-counting strategies.

(2) Ben biliyorum [$_{S1}$ [(geçen gelen / genç) haberci-nin] [$_{S2}$ [(bugün öl-en / yaşlı) polisin]
I know recently come-REL / young journalist-GEN today die-REL / old cop
[$_{S3}$ [(hastalanan / tedirgin) öğretmen-in] konuşmasını] dinlemesini] görüntülediğini.
get_ill-REL / agitated teacher-GEN speak listen to film
'I know that the (young) journalist (who visited recently) filmed the (old) cop (who died today) listening to the (agitated) teacher (who got ill) speak.

The percentages of 'acceptable' responses for grammatical and ungrammatical sentences respectively were 81% and 65% in bare conditions, 81% and 76% in adjective conditions, 83% and 73% in RC conditions, and 91% and 8% for fillers. For experimental items, a generalized linear mixed-effects model showed an effect of grammaticality (β=.83, SE=.15, z=5.4), and a significant interaction between grammaticality and the presence of modification (β=.4, SE=.13, z=2.9), but no interaction between grammaticality and modification type (β=-.4, SE=0.26, z=-1.5).

The approximately equal error rates for both grammatical and ungrammatical filler sentences suggest that the high percentage of 'acceptable' responses in ungrammatical conditions might be due to a grammaticality illusion instead of a response bias. Thus, our results are the first demonstration of a missing VP effect in a strictly head-final language. Moreover, our findings suggest that the parser is more likely to overlook the absence of a verb if that verb's subject is also involved in another grammatical dependency, but that the specific type of the modification (here: adjectives or RCs) does not seem to matter.

Using content and timing predictions to prepare and articulate turns during conversation

Ruth E. Corps, Chiara Gambi, & Martin J. Pickering; PPLS, University of Edinburgh

During dialogue, interlocutors take turns at talk so that there is little overlap or gap between their turns [2]. According to Garrod and Pickering [1], interlocutors achieve such coordination by predicting the content (i.e., the speaker's intended message) and timing (by tracking or entraining to speech rate; [3]) of the speaker's utterance. While listeners can use content predictions to prepare a response, timing predictions are used to ensure this response is initiated at the appropriate moment.

But how are these two mechanisms related? If the content of the speaker's utterance is predictable, then the listener may be able to predict the final word and its syllable length. Based on their speech rate entrainment, listeners could predict how long the speaker takes to produce a single syllable, and thus how long they will take to produce the final word. However, no study has investigated (i) how speech rate influences response timing, and (ii) whether such timing predictions interact with turn content.

We investigated these issues in two yes/no question-answering experiments using time compression techniques. Questions were presented at their original rate or at twice the speed. Experiment 1 used unpredictable questions in one of four versions, where speech rate was the same for both the context and the final word (original-original and fast-fast conditions) or changed on the final word (original-fast and fast-original conditions). To de-confound rate from final word duration, linear mixed models with maximal random structure were fit to answer times from final word onset. Listeners (N=32) responded earlier after a fast (M=947ms) than an original context (M=966; t=-2.23), suggesting they entrained to the base rate of the question. Additionally, listeners responded later to a fast-original (M=1001) than a fast-fast utterance (M=891; t=-7.46) and earlier to an original-fast (M=908) than an original-original utterance (M=1024; t=-7.80), suggesting they updated their rate predictions after encountering a final word differing from the rest of the utterance.

In Experiment 2, we used the original-original and original-fast conditions to investigate whether speech rate predictions interacted with turn content. Content predictability was manipulated so that listeners (N=32) could (e.g., *are dogs your favourite* ***animal***?) or could not (e.g., *do you enjoy going to the* ***supermarket***?) predict the final word. Listeners were quicker to answer when content was predictable (M=666) rather than unpredictable (M=947; t=-5.21), suggesting they used content predictions to prepare a response. We also replicated the final word effect from Experiment 1: Listeners responded earlier to an original-fast (M=747) than an original-original utterance (M=864; t=-6.69). However, there was no interaction between content and final word rate (t=1.32).

We conclude that listeners use content predictions to prepare a response and speech rate predictions to time articulation. However, these processes are largely separate, suggesting that listeners can prepare their response without necessarily knowing when they will have the opportunity to articulate.

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The Influence of Script Knowledge on Language Processing: Evidence from ERPs

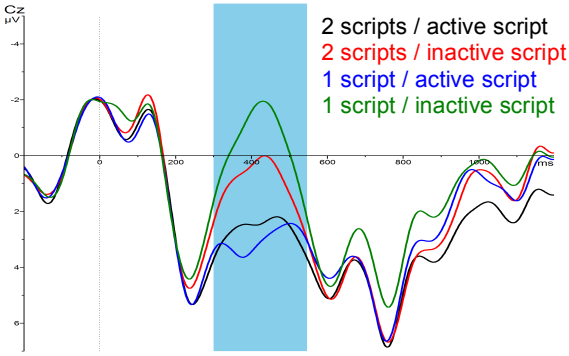
Elisabeth Rabs, Heiner Drenhaus, Francesca Delogu & Matthew Crocker
Saarland University

Previous research has shown that the semantic expectedness of a word – as established by the linguistic context – is negatively correlated with N400 amplitude [1]. While such evidence has been used to argue that the N400 indexes semantic integration processes, findings can often be explained in terms of facilitated lexical retrieval, which, among other factors, is influenced by lexical/semantic priming. In the present study we examine this issue by manipulating script event knowledge [2] – a person's knowledge about structured event sequences – which has been previously shown to modulate the N400 [3].

An ERP-study (German) investigated whether N400 modulation by a mentioned script event is due to priming alone, or is further sensitive to linguistic cues which would be expected to modulate script influence. Participants (n=32, mean age=29) were presented with a 2x2 design, containing a context introducing either one script, or two scripts, where one of them marked as inactive by an "*instead-of*"-construction. An introduction sentence also served to reinforce the active script. The direct object of the word-by-word (SOA=400+100ms) presented target sentence was related to either the active or inactive/unmentioned script. Materials were normed in a plausibility judgement task.

Context Sentence:	
Introduction:	Roberta's cold had gotten worse.
2 Scripts:	Instead of going to the post office, she went to the pharmacy.
1 Script:	She went to the pharmacy.
Target Sentence:	
Active Script:	She entered and handed over the ***prescription*** with a smile.
Inactive Script:	She entered and handed over the ***package*** with a smile.

Figure 1: all conditions on target object (in bold) measured at electrode Cz; data was filtered for presentation purposes only with 8hz low-pass filter



Fitted linear mixed models (300-500ms time window after target onset) reveal a significant (t>|2|) main effect for active script fit, shown in a broadly distributed N400 for inactive script target vs. active script target, as well as an interaction with context size. We thus replicate the finding that script knowledge rapidly facilitates processing of active (vs inactive) script-matching targets [3]. Importantly, priming accounts alone cannot fully account for the N400 difference between active and inactive script targets in a 2-script context. Equally, however, the N400 difference between the two inactive script matching conditions indicates that linguistic cues like "instead of" cannot fully suppress the influence of the mentioned but inactive script. Rather, the partial modulation of the N400 by such cues provides further evidence for an interaction between linguistic cues and event knowledge in modulating the N400 [3].

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Who are you talking about? Individual differences in pronoun comprehension

Jennifer Arnold[❖], Iris Strangmann[⊙], Heeju Hwang[□], Sandy Zerkle[❖], Laura Castro-Schilo[§]
UNC[❖]; CUNY Graduate school[⊙]; U. Hong Kong[□]; SAS[§]; jarnold@unc.edu

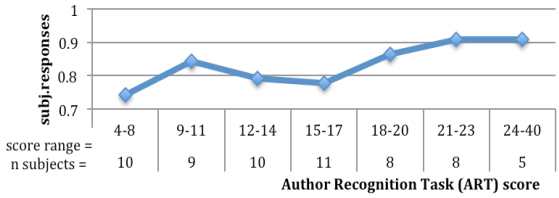
Does individual variation in type of linguistic exposure affect processing strategies? We know that input affects language development [1] and reading proficiency [2], but less is known about how it affects spoken language processing. We ask how pronoun comprehension is shaped by the input, specifically exposure to written language.

Pronouns like *he* and *she* are ambiguous, e.g. in *Jill went skiing with Sue. She fell down*, "she" could refer to either character. Adults follow several heuristics to interpret pronouns, including a bias toward the grammatical subject, e .g. Jill [3]. They also follow social cues such as eye gaze and pointing [5]. Children do not follow the subject bias as readily [4]. An unsolved puzzle is how these constraints are integrated, and why interpretation varies across individuals and situations. We hypothesized that exposure to written language increases one's reliance on linguistic cues over social cues. Written texts are thematically organized, decontextualized, and complex, and may provide an ideal environment for learning the how language encodes information status.

We tested three populations: 1) Adult native speakers; 2) Adult L2 speakers; 3) Children, using stimuli from [4]. Participants watched videos of a woman tell stories about two same-gender characters, e.g. *Puppy is reading with Panda Bear. He wants the black book.* Each puppet sat on a table in front of the speaker. At the pronoun, the speaker gazed at either 1) the subject (Puppy), 2) a neutral point (the book), or 3) the nonsubject (Panda). The next screen asked "who wants the black book?" If speakers rely on the linguistic context, they should choose the subject character; if they rely on gaze, they should choose the gazed-at character, and perform at chance in the neutral condition.

For adults, we tested individual differences in print exposure using the Author Recognition Task [6], which is a proxy for exposure to written material, and correlates with measures of reading performance [7]. For children, we used the Title Recognition task [8].

Adults Native speakers (N=61) . Participants followed both subject and gaze biases, selecting the subject as pronoun referent 87% of the time in the neutral condition, 93% in gaze-to-subj. and 67% in gaze-to-nonsubj. conditions. **Critically, people with higher ART scores chose the subject more (see Fig.).** There was no effect of working memory.



Adult L2 speakers (N=62). Proficient L2 English speakers performed the ART in both their native L1 Mandarin and L2 English. They did the same video task in English, including both gaze conditions and conditions in which the speaker both gazed and pointed. Gaze and pointing both had the expected effects. **In addition, people with higher ART scores in Mandarin (but not English) chose the subject more.** Thus, print exposure transfers from one language to another. Children ages 5-14 (n=54). Gaze again had the expected effect. In addition, **children with higher print exposure chose the subject more**. This effect eliminated the effect of age when both were in the model.

These findings show that written language experience modulates spoken language processing, identifying one source of variation in pronoun comprehension. Theoretically, this supports models in which the input shapes language processing mechanisms during both development and adulthood, and in ways that transfer to other languages.

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The lexical boost in production priming: Evidence for the special role of the verb

Maria Nella Carminati (University of Strathclyde, maria.carminati@strath.ac.uk)
Roger van Gompel (University of Dundee, r.p.g.vangompel@dundee.ac.uk)

One important finding in research on structural priming in production is that priming is enhanced when words (e.g. the verb) are the same (vs. different) between prime and target, supporting the view that syntactic structure representations are also to some extent lexically-specific, i.e., associated with individual words (e.g., Pickering & Branigan 1998). In this regard, a key question is whether this priming enhancement (termed the 'lexical boost') occurs only when lexical heads (i.e., words that sub-categorise for a syntactic frame) are repeated, or whether it occurs also with lexical nonheads. In this respect, two influential theoretical accounts of syntactic priming make different predictions: According to Pickering & Branigan's (1998) Residual Activation Model, a lexical boost is expected only when lexical heads are repeated; on the other hand, Chang et al.'s (2006) Implicit Learning model predicts the boost with the repetition of any content word (as a result of an explicit memory mechanism, which is different from the implicit learning mechanism responsible for lexically-independent priming). While experimental evidence of a lexical boost when syntactic heads are repeated is robust (e.g., Branigan et al. 2000; Corley & Scheepers 2002; Bernolet et al. 2014; see also Melinger & Dobel 2005), it is still unclear whether the repetition of nonhead words leads to a lexical boost.

In three structural-priming experiments, we investigated lexical boost effects in the production of English ditransitive sentences, using a variant of the sentence completion method (Pickering & Branigan 1998). In the critical trials, participants read a prime (double object/prepositional object) sentence aloud, after which they had to orally describe a picture by completing a fragment presented under the picture. The subject noun was the same or different in prime and target in Experiments 1-2, while the verb was always different in Experiment 1, and the same or different in Experiment 2. We observed a priming effect and a lexical boost when the verb, the syntactic head of the ditransitive structure, was repeated. However, repetition of the subject (a nonhead) did not lead to a lexical boost. Experiment 3 manipulated the repetition of the VP-internal nonhead arguments, i.e., theme and recipient (3 levels of repetition: no repetition, theme repetition, recipient repetition). Prime and target had different verbs. Priming occurred; however there was no lexical boost whatsoever as a result of the repetition of the theme, or the recipient. These findings support the view that structural information is stored with syntactic heads (i.e., the verb), but not with nonheads such as the subject noun and the VP-internal arguments (Pickering & Branigan 1998).

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Symmetric priming of enrichment in aspectual and intensional constructions

E. Matthew Husband <matthew.husband@ling-phil.ox.ac.uk> & Aine Ito
University of Oxford

Sentence meanings sometimes require enrichment operations, like coercion, to compose their meanings, causing these sentences to carry implicit meanings. Aspectual verbs (*begin*) and intensional verbs (*want*) both select for event-denoting complements either as VPs (*begin/want to read the book*) or NPs (*begin/want the reading*), and acquire an implicit meaning when their NP complement denotes an entity (e.g., 'reading' in *begin/want the book*). Linguistic theory posits two different types of enrichment: enrichment by semantic type shift with aspectual verbs, and enrichment by covert syntactic insertion with intensional verbs (Pylkkänen, 2008). We hypothesised that such operational differences could be detected by investigating the process of constructing enriched structures. Thus, we conducted a structural priming study to tap into the construction of enriched structures in aspectual and intensional constructions (Raffray, Pickering, Cai, & Branigan, 2014).

Native English speakers saw sentence fragment + picture pairs, and were instructed to complete each fragment to describe the picture. In prime trials, the sentence fragment induced participants to produce either an NP complement (e.g., *The mouse began/wanted the* __) or VP complement (e.g., *The mouse began/wanted to eat the* __). In target trials, the sentence fragment could be completed with either an NP or VP. We coded prime and target completions as either entity- or event-denoting. In Experiment 1 (N=64), the target fragment contained the same verb as the prime (e.g., *The woman began/wanted* __). In Experiment 2 (N=64), the target contained another verb of the same (aspectual or intensional) verb type (e.g., *The woman started/needed* __).

In both experiments, participants were more likely to produce Enriched vs. Unenriched structures for intensional verbs compared to aspectual verbs (ps<.01). In Experiment 1, when participants' primes were Entity-denoting nouns (requiring enrichment) vs. Event-denoting nouns (no enrichment), they were more likely to produce an Enriched structure than an Unenriched structure (53% vs. 24%; z=3.4, p<.001), regardless of verb type (p=.25). In Experiment 2, participants' likelihood of producing enriched structures was not affected by prime completion or verb type (ps>.4).

The enrichment priming effect did not interact with verb type, suggesting that the magnitude of enrichment priming is equivalent for aspectual and intensional verbs. Thus, enrichment by semantic type shift and by syntactic insertion may involve similar cognitive processes. However, we found enrichment priming only when the verb was repeated (i.e., lexical boost), suggesting that the enrichment processes may be tightly linked to specific constructions. Aspectual and intensional verbs did show some distinction: event-denoting nouns were frequently produced with aspectual verbs (Exp1=20.9%; Exp2=21.9%) but dispreferred with intensional verbs (Exp1=4.7%; Exp2=1.8%), suggesting an underlying grammatical difference.

Table. The proportion of enriched responses after each type of prime completion (with standard errors).

		Experiment 1 (Repeated Verb)			**Experiment 2 (Different Verb)**		
		Prime Completion					
		NP Entity	*NP Event*	*VP Event*	*NP Entity*	*NP Event*	*VP Event*
Verb Type	Aspectual	.32 (.03)	.19 (.03)	.24 (.02)	.20 (.02)	.13 (.02)	.17 (.02)
	Intensional	.69 (.02)	.50 (.08)	.48 (.02)	.35 (.03)	.38 (.13)	.35 (.02)

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Ageing and sentence production: Effects of syntactic planning and lexical access

Sophie M. Hardy, Katrien Segaert & Linda Wheeldon, University of Birmingham

Unlike other cognitive functions, language does not experience universal decline with age (Burke & Shafto, 2008).This poses a challenge for theories of language and ageing which must account for how and why particular aspects of language are impaired by age, while others are preserved. Rapid generation of syntax and lexical access is required for fluent sentence production. We therefore investigated these processes in a sample of 40 young (*M*=19.7yrs) and 19 older adults (*M*=73.5yrs, data collection ongoing).

Participants completed a timed picture description priming task (Smith & Wheeldon, 2001), producing a syntactically related or unrelated prime prior to a target sentence (e.g., *"the bell and the leaf move up"*). Secondly, we conducted a planning scope task (Wheeldon, Ohlson, Ashby, & Gator, 2013) with initial coordinate or initial simple noun phrases (e.g., *"the owl and the car move above the harp" / "the owl moves above the car and the harp"*). On half the trials the second picture was previewed (e.g., car)*;* critically, the previewed picture name only fell within the initial noun phrase in the coordinate condition.

In both tasks, older adults were slower and more error-prone than young adults; nevertheless, they displayed similar patterns of syntactic processing. Both groups display benefits of prior access to syntax (Fig. 1A), yielding similar priming effects of 4.5% (young) and 5.0% (older). Both groups also displayed a phrase effect without picture preview, suggesting similar planning scope (Fig. 1B). However, age differences did emerge in the preview condition: in contrast to young adults, the preview picture inhibited older adults' production when it fell outside the initial noun phrase. Thus, while syntactic planning mechanisms do not appear to be affected by age, older adults do encounter problems in the management of the activation and assignment of lexical items to syntactic frameworks.

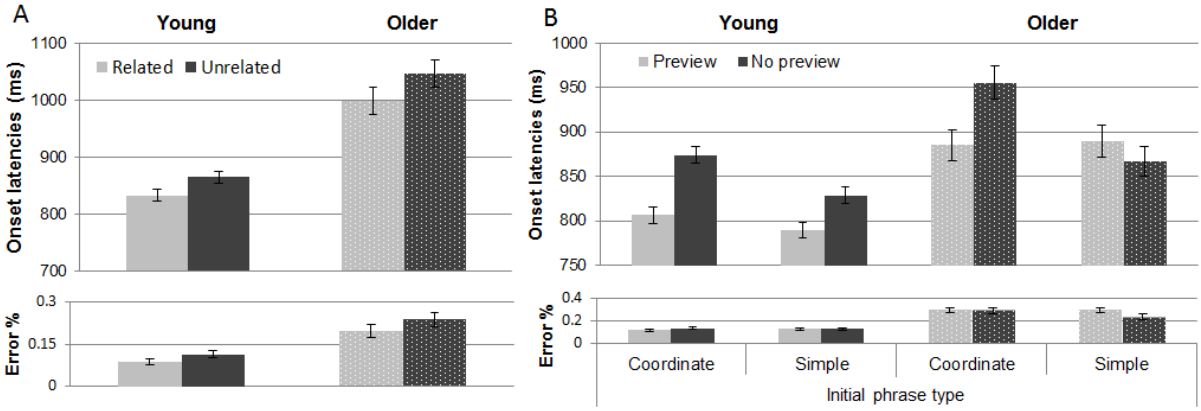


Figure 1. (A) Young (p<.012) and older adults (p<.080) showed a facilitatory effect of priming. (B) In the no preview condition, young (p<.001) and older adults (p<.002) were quicker to produce sentences with initial simple noun phrases than coordinate noun phrases. Young adults showed a facilitory effect for preview in both phrase types (p<.001), which was greater when the preview fell within the initial noun phrase (p<.063). By contrast, older adults showed facilitation only when the preview picture fell within the initial noun phrase; there was a negative effect of preview when the picture fell outside of the initial noun phrase (p<.012).

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Sentence-level learning mechanisms support lexical-semantic retuning during ambiguity resolution

Rebecca A. Gilbert[1,2], Matthew H. Davis[2], M. Gareth Gaskell[3], Jennifer M. Rodd[1]
[1] University College London, [2] MRC Cognition and Brain Sciences Unit, [3] University of York

Lexical-semantic representations are more malleable than previously thought. A single presentation of an ambiguous word in a sentence context (e.g. "She danced at the ***ball***") can result in the 'retuning' of lexical-semantic representations. This retuning is apparent when the ambiguous word is re-encountered minutes or hours later without any biasing context; interpretation is shifted toward the previously encountered meaning (Rodd et al., 2016). The present study explored the learning mechanism that underlies this retuning effect by investigating the impact of the prime sentence structure.

One possibility is that this retuning is driven by an associative learning mechanism in which the connection between a word's form and a particular meaning is strengthened whenever the two representations are co-active. A strong version of this account predicts that priming will be maximal when the disambiguating context occurs *before* the ambiguous word (e.g. "Sally worried about how crowded the ***ball*** would be"). This structure ensures that the appropriate subordinate meaning can become active immediately following the ambiguous word. Alternatively, learning might emerge as a result of sentence misinterpretation, where lexical-semantic representations are changed in order to reduce future errors. This 'error-driven' account predicts that priming will be maximal when the critical context is given *after* the ambiguous word (e.g. "Sally worried that the ***ball*** would be too crowded"), since these sentences are likely to be initially misinterpreted. Finally, learning may be driven by the output from the overall sentence interpretation processes and evident whenever the word is correctly understood, regardless of sentence structure.

Adults heard ambiguous words embedded in well-matched early- and late-disambiguation sentences while making semantic relatedness judgements. After a 20 minute delay, their interpretation of primed and unprimed (baseline) ambiguous words was tested using word association (Experiment 1 and 3), and speeded relatedness decisions (e.g., "ball: DANCE", Experiment 2 and 4). Experiment 1 (N=30) showed significantly greater priming from early- than late-disambiguation sentences. However, Experiment 2 (N=89) showed that priming from late-disambiguation sentences can occur, but is significantly modulated by the difficulty of the prime task: greater priming was observed from "yes" trials than from the easier "no" trials, where correct responses could be made without full disambiguation. Thus, the absence of late-disambiguation priming in Experiment 1 may reflect participants' failure to fully disambiguate these sentences. In Experiments 3 and 4 (N=180; 109) we encouraged full disambiguation by adding a second sentence to each prime trial and including occasional comprehension questions. These experiments showed significant priming in *all* primed conditions with no difference in priming between the early- and late-disambiguation conditions.

These data rule out strong versions of the 'associative' and 'error-driven' accounts. Instead we conclude that lexical-semantic retuning emerges from relatively late stages of sentence processing when listeners have generated a final representation of sentence meaning. The task-dependent retuning effects seen in Experiments 1 and 2 likely result from 'good enough' comprehension processes, whereby listeners only fully disambiguate late-disambiguation sentences when specifically required to do so by the task demands.

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Speaker-specific expectations about precision

Christina S. Kim and Vilde R. S. Reksnes, University of Kent

Two classes of scalar adjectives are investigated: relative adjectives (RA) like *tall*, and (maximum standard) absolute adjectives (AA) like *empty.* Both are context sensitive: in sentences like *The candle is tall* or *The glass is empty*, the standard for what counts as *tall* or *empty* varies with aspects of the context of use. It is largely agreed that interpreting RAs requires a comparison set supplied by the context; the comparison set fixes the standard for what counts as *tall*. However, there is ongoing debate about the source of variability for AAs [1-3]. Unlike RAs, AAs can be interpreted without reference to a comparison set (e.g. a 100% empty glass). Previous research has argued that interpreting AAs instead involves setting a standard of precision [1-2], i.e. asking how much 'pragmatic slack' can be tolerated given the goals of the conversation, the norms of the situation, or what is known about the speaker. We tested one prediction of such theories: that standards of precision should vary by properties of the speaker, while standards of comparison for RAs should only be a function of the contextually-supplied comparison set.

Participants (n=20) saw a series of set of objects, each varying along some continuous scale (e.g. height of a candle, volume of liquid in a glass). A recorded speaker asked them to indicate which objects counted as e.g. *tall* or *empty*. Crucially, the speaker was varied across two trial blocks: one had a backstory suggesting she was highly detail-oriented (Precise speaker), while the other's backstory emphasized that he was inattentive to detail (Imprecise speaker). The judgment data was fitted with mixed-effects logistic regression models predicting "Yes" responses, by location on the scale (point1: tallest/emptiest to point5: least tall/least empty), adjective type (RA, AA), and speaker order (whether Precise or Imprecise speaker was seen first).

As expected, RAs were judged based only on the comparison set: the only reliable predictor of responses at each point on the scale was the response on an adjacent point on the scale (e.g. a candle was likely to be judged as *tall* if the candle closest to it in height had also been judged as *tall*) (β=.82,p<.0001). For AAs, responses to the precise item (e.g. maximally empty glass) were almost uniformly "Yes". For the item closest to the precise meaning on the relevant scale (e.g. glass closest to 100% empty), "Yes" responses were more likely with the imprecise speaker (β=.073,p<.05), showing that expectations about a speaker's level of precision influenced judgments about AAs. For the remaining items in the set (points3-5), AAs resembled RAs in being predicted primarily by judgments on scale-adjacent items. In addition, participants exposed to the precise speaker first showed more precise judgments across the board than those who saw the imprecise speaker first (β=.059,p<.05). This order effect could reflect [4]'s observation that raising the standard of precision to be more precise seems easier than loosening it to be more permissive.

The present study supports an account of AAs involving pragmatic reasoning about standards of precision, by showing that inferences about speaker intent influence judgments about AAs. Further, once imprecise interpretations are permitted, AAs display the same comparison set-dependence as RAs, and may therefore involve similar mechanisms for determining standards from the comparison set supplied by the context.

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Discourse expectations and updating independently and additively affect pupil size in the processing of reference transfer

Andreas Brocher, Franziska Kretzschmar, and Petra Schumacher
University of Cologne

There is evidence from event-related potentials (ERPs) that the processing of reference transfer is affected by two distinct processes: discourse expectations and discourse updating. Specifically, Schumacher (2011) found that reference transfer associated with noun phrases (*the rosé*; example 2) yields a late positivity in comparison to literal controls (example 1). In addition, in the absence of supportive context, the positivity is preceded by an N400 effect (4>3; cf. Schumacher, 2014). While the N400 is assumed to reflect expectation-based processing (with reference transfer being unexpected without supportive context), the late positivity indexes discourse updating for meaning shifts across contexts. In the present study, we aimed at replicating these effects using pupillometry in order to obtain additional evidence for discourse expectations and updating. In addition, and perhaps more importantly, the German materials used by Schumacher (2011, 2014) allowed us to test for pupil size equivalents of (a) expectation effects associated with the N400 (1 vs. 3), (b) discourse updating in the late positivity (1/3 vs. 2/4), and (c) joint effects (1 vs. 4).

Example stimuli:

1. *Ausverkauft, sagt die Kellnerin leise, ist der Rosé schon seit einer Stunde*.
   Sold out, says the waitress quietly, is the rosé already since an hour.
   'The waitress says quietly that the rosé has already been sold out for an hour.'
2. *Bezahlt, sagt die Kellnerin leise, hat der Rosé schon vor einer Stunde*.
   Paid, says the waitress quietly, has the rosé already ago an hour
   'The waitress says quietly that the rosé has already paid an hour ago.'
3. *Ausverkauft, sagt Heinrich leise, ist der Rosé schon seit einer Stunde*.
4. *Bezahlt, sagt Heinrich leise, hat der Rosé schon vor einer Stunde*.

Sixteen participants read single sentences with RSVP (phrases: 400 ms + 200 ms ISI) and matched probe words after sentence presentation. Critical noun phrases (*the rosé*) were identical across conditions and embedded in a 2 (transfer [2,4] vs. literal [1,3]) x 2 (related context [1,2] vs. unrelated context [3,4]) design. We measured peak pupil size for the critical NP. Pupil size was calculated within 1750 ms post critical noun onset and then baseline corrected by subtracting peak pupil size of the 250 ms immediately preceding the word of interest (see Kafkas & Montaldi, 2015). At NP positions, pupils were largest for transferred reference following related context (2) and smallest for literal interpretations following unrelated context (3). Literal interpretations following related context (1) and transferred reference following unrelated context (4) fell in between. Log-likelihood ratio tests, comparing mixed linear regression models of increasing complexity, revealed that the model including the linear combination of noun interpretation and context yielded the best fit to the data, $X(2) = 4.33$, $p = .038$. These data suggest that pupil size reflects expectation-based and updating-based processes as well as the addition thereof in sentence comprehension, supporting previous findings. On a more general level, pupillometry might be an interesting alternative to ERPs in sentence comprehension. Just like ERPs, pupil size is under very little control to a participant. However, pupil size is arguably easier to measure in specific populations, such as children and the elderly. Interestingly, however, pupil size does not seem to distinguish between processing cost (reference transfer) and facilitation (supportive context), which is likely to limit the questions that can be addressed.

Referring through rose-colored glasses: conceptual pacts under uncertainty

Adriana Baltaretu, Craig G. Chambers, *University of Toronto*

Interlocutors typically design descriptions to successfully distinguish referents from available alternatives, and reuse these descriptions once they are established (conceptual pacts). This study explores how speakers' referential strategies are affected by perceptual uncertainty and changing knowledge about objects' color.

In a modified referential communication task, participants described objects located in compartments within a shelf display for an addressee sitting beside them (speakers also had a private screen prompting the next object to mention). Most objects in the display (including targets) were paired with another same-category object, making modifiers necessary. On critical trials, targets were located behind a fully transparent panel or a colored panel mounted on the front of the shelf display that changed the objects' actual color (e.g., a purple object seen through a green panel would look blue from the front side of the shelf display, yet purple from the back or when viewed through a transparent panel). Target objects were referred to either one time (low entrainment 'LE') or three times (high entrainment 'HE') before a test round. On the test round, both interlocutors first watched the shelf display rotate 180° (revealing the actual color of any objects behind colored panels), and the speaker was then prompted to refer to earlier-mentioned objects. We first analyzed speakers' tendency to abandon an earlier-used color adjective in favor of a new one. Speakers were more likely to change the color term when the panel was colored (72% of the time vs. 8% with transparent panels). Interestingly, this was not affected by the HE vs. LE manipulation. Moreover, separate raters judged these "switched" descriptions as indistinguishable from non-switched descriptions (e.g., exhibiting no detectable hesitation, etc.), suggesting speakers can effortlessly abandon conceptual pacts when relevant (see also [1,2]). However, speakers were more likely to use a color term in the test round if they had used a (different) color term in previous rounds (M = 0.91). Next, we examined the form and content of referring expressions during the earlier rounds. When the panel was transparent, color adjectives were used most often, and location was rarely used. When the panel was colored, uncertainty about the objects' actual color boosted the initial use of other descriptive strategies for the intended object (on average, in each game round, location occurred in 24% cases and a combination of location plus color in 22% cases, in the LE condition. In the HE condition, location occurred in 14% cases and location plus color in 26% cases). These patterns are notable because even a "wrong" color could be used to ensure referential success in the pre-test rounds. Further, in the HE condition, there was an intriguing decrease in the use of modifiers across the game. In fact, in rounds 2 and 3, speakers generated descriptions with NO modifiers (which were technically referentially ambiguous) 20% of the time on average. In addition, the length of the descriptions (number of words) significantly decreased across the game rounds. Most importantly, our results suggest that speakers design references in a highly flexible way that includes not only abandoning previous (entrained) descriptions as needed but also attempting to proactively manage trade-offs between optimal descriptions and uncertainty. We are currently testing the impacts of this referential behavior on real-time comprehension.

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Temporal and benefactive *for*-phrases prime differently: Evidence against phrase structural accounts of persistence

Michael Baumann & Sandra Pappert (Bielefeld University)
michael.baumann@uni-bielefeld.de

Speakers tend to reuse linguistic structures in consecutive utterances given meaning equivalent alternatives. This behavior has been termed structural persistence and is suggested to inform about cognitive representations and mechanisms (cf. Pickering & Ferreira, 2008). Persistence across thematic roles favors phrase structural accounts (Bock & Loebell, 1990) whereas demonstrations of word order persistence across phrase structure indicate an involvement of thematic roles (Pappert & Pechmann, 2014; for an integrated account cf. Cai, Pickering, & Branigan, 2012).

To dissociate the predictions of the phrase structural and the conceptual account, we conducted a structural priming experiment in German. The impact of temporal *for*-primes (c) on the generation of benefactive alternation responses from a word list (e) was compared to the effect of benefactive *for*-primes (a) and benefactive dative primes (b). Mono-transitive structures (d) served as a control. The phrase structural account predicts that the temporal *for*-phrases prime benefactive *for*-phrases like benefactive *for*-phrases do and that benefactive datives and mono-transitives behave differently. By contrast, the thematic roles account predicts that temporal *for*-phrases do not produce the same priming pattern as benefactive *for*-phrases do.

GLMMs were computed on *for*-phrase (vs. dative) responses from 40 participants (Table 1). Results revealed a main effect of prime type ($p < .001$). Planned comparisons (all $p < .05$) showed a higher relative number of *for*-responses after benefactive *for*-primes than after benefactive dative (*diff* = 25.4%) or mono-transitive primes (*diff* = 15.9%). There were more *for*-responses after temporal *for*-primes than after benefactive dative primes (*diff* = 9.5%;). But crucially and against the predictions of a syntactic account, the proportion of *for*-responses after temporal *for*-primes differed from that after benefactive *for*-primes (*diff* = 15.3%). Additionally, it could not be rejected that proportions after *for*-temporals and after mono-transitives in our sample were the same (*diff* = 0.6%; $p = .54$).

These results speak clearly against phrase structure as a driving force in structural persistence. Instead they corroborate the assumption that persistence originates at the conceptual level or shortly thereafter when thematic roles are mapped onto syntactic forms.

Der Zirkusdirektor öffnet (the circus director opens) ...
(a) *den Vorhang für den Clown* (the.ACC curtain for the clown)
(b) *dem Clown den Vorhang* (the.DAT clown the.ACC curtain)
(c) *den Vorhang für zehn Sekunden* (the.ACC curtain for ten seconds)
(d) *den Vorhang* (the.ACC curtain)
(e) *mieten* (rent) *Regisseur* (director) *Strandhaus* (beach house) *Filmstar* (movie star)

Table 1. Relative number of *for*-benefactive (vs. dative benefactive) responses per prime type.

prime type	*for*-benefactive	dative benefactive	*for*-temporal	mono-transitive
%	72.8	47.4	57.5	56.9

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Lexical and conceptual anticipation in native and non-native speakers' processing of verb-noun collocations

< Cylcia Bolibaugh, University of York>

Two important questions in any predictive account of language processing concern the circumstances in which predictions are generated, and the specificity of the predictions themselves. The answers to these questions are also needed to inform theories of second language learning: findings that non-natives do not typically generate predictions as native speakers do have been attributed to a variety of explanations, ranging from e.g., qualitatively different processing mechanisms, to implicitly learning not to predict (Hopp 2016). One possibility is that second language speakers do generate predictions, but at a less precise level than native speakers do.

The present study explores the possibility that non-natives may develop expectations for upcoming topics or concepts, while still having difficulty generating specific predictions about the words that encode these. Adapting a paradigm developed by Thornhill and Van Petten, 2012, we exploit the phenomena of lexical collocation to measure native, and advanced non-native, speakers' sensitivity to violations of conceptual and lexical expectations. Lexical collocations are particularly suited to this investigation as they instantiate both *co-textual* predictability, via statistical association between syntagmatically related forms, as well as *contextual* probability, as the canonical expression of particular concepts (e.g. *brush teeth* vs *brush dentals*).

In a eye tracking study experiment, native and very advanced non-native speakers read high/low constraint sentences which contained either highly predictable [BEST] sentence completions, semantically similar but lexically discrepant [RELATED] completions, or completions which were discrepant on both counts [UNRELATED].

The coach's constant criticism caused Jim to **lose** ***confidence****/morale/work* last year.
She didn't know what caused Jim to **lose** ***confidence****/morale/work* last year.

BEST completions were created from verb + noun collocations (*lose confidence*), with mutual information scores ≥ 4, embedded in frames with high/low cloze probability. Measures of target and post-target reading times allow us to determine not only the lexical specificity of native and second language speakers' expectations, but also whether expectations generated on the basis of statistical association are independent from contextual predictability.

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The interpretation of pronouns in bilingual Italian speakers: a visual world experiment

Michela Bonfieni, Martin J. Pickering, Holly P. Branigan and Antonella Sorace
University of Edinburgh

Bilingual speakers do not always interpret grammatical structures in the same way as monolinguals. Null and overt pronoun sentences in Italian are one such example:

a. La cameriera$_i$ chiama la ricercatrice$_j$ mentre i messicani mangiano. Ø$_{i/?j}$ e' molto severa.
b. La cameriera$_i$ chiama la ricercatrice$_j$ mentre i messicani mangiano. Lei$_{i?/j}$ e' molto severa.
(The waitress calls the researcher while the Mexicans eat. She is very strict.)

Bilingual speakers co-refer the overt pronoun in (b) to the subject antecedent ('the waitress') more often than monolingual speakers (Tsimpli et al., 2004; Belletti et al., 2007). Researchers explain this pattern by proposing that interpreting pronouns requires resource-demanding integration of syntactic and pragmatic information. This extra load causes bilinguals resort to default interpretational strategies (e.g., pronoun=subject). Crucially, these defaults may not involve transfer from their L1 strategies (Sorace, 2011).

We used a visual world paradigm to investigate on-line (eye movements) and off-line (forced-choice responses) interpretation of Italian pronouns in Italian bilinguals compared to monolinguals. We evaluated cross-linguistic differences and bilingual language processing by comparing Italian-English (I-E) bilinguals (+/- null subject languages, n=36) and Italian-Sardinian (I-S) bilinguals (+/+ null subject languages, n=38) to Italian (I) monolinguals (n=46). All groups co-referred the overt pronoun to the object antecedent more often than the null pronoun, as reflected in both eye-movements (proportions of object fixations after overt pronoun .29 vs .23, $p = .0003$) and explicit responses (proportion of object responses after overt pronoun .56 vs .46, $p = .041$).

However, I-S bilinguals showed a stronger preference than I-E bilinguals and I monolinguals to interpret the subject as the antecedent for both pronouns in their explicit responses (proportion subject responses: I-S .60; I-E .43 and I .41; $p = .0009$); this difference was marginal in their eye-movements (proportions of subject fixations: I-S .30, I-E .24, I .26, $p = .068$). Although the interaction between pronoun type and group was not significant, I-S bilinguals did not show a marked difference in the interpretation of overt pronouns in their eye-movements compared to the other groups (difference in proportions of fixations: I-S .04, adjusted $p = .556$, vs both I-E and I .08, adjusted $p < .010$). Surprisingly, and in contrast to previous results, the I-E bilinguals did not show any difference in their interpretational preferences compared to the monolinguals.

These results support the existence of default interpretational strategies that are independent of cross-linguistic differences, which we discuss in reference to aspects of the bilingual experience, such as age of onset of bilingualism. This study contributes to the understanding of variability in linguistic processing in multilingual communities, from the perspectives of both cognitive processing and the dynamics of language change.

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Cognitive factors influence rate and type of linguistic change in the vocabulary

James Brand[1] *and Padraic Monaghan*[1,2]
[1]*Lancaster University*
[2]Max Planck Institute for Psycholinguistics

Languages, like living organisms, evolve. Whilst significant progress has been made in identifying what drives languages to change and undergo evolutionary adaptations, fewer attempts have been made to explain why certain features and properties have remained stable over the course of transmission. Recent research utilising methods from cladistics and phylogenetics have enabled empirical investigations into the rate of change of distinct words in the vocabulary of a community. Some words change rapidly, whereas others are more stable, and there is strong support for cognitive explanations of linguistic change [1], such as high-frequency, early-acquired words more likely to be invulnerable to adaptation. Such studies highlight the important roles that cognitive factors, such as language processing and learning, play in the differential rates of linguistic change, generating evidence for why we observe varying rates of linguistic evolution. Yet these corpus-based studies provide only correlational evidence of cognitive processing effects in language change, rather than testing causally how changes come about. Furthermore, these previous studies have not distinguished changes that are small, incremental adjustments of a word from more drastic replacements of the word which are likely underwritten by different cognitive and linguistic processes.

We present here a novel experimental approach to test how psycholinguistic properties of words (such as frequency, length and AoA) can explain rates and types of linguistic change. Through a series of laboratory based artificial language learning experiments where participants had to acquire a set of form-meaning mappings of words, we first examine how these properties influence the likelihood of accurate reproduction of the vocabulary, or errors in acquiring the form of words Then, using Monte-Carlo methods, we provide an empirical test to assess the magnitude of individual errors, enabling us to distinguish between lexical adjustments (where there is some resemblance to the original word) or replacements (where there is no resemblance to the original word). We also examine which part of the word is most likely to change, by analysing the initial/middle/final parts of the words in the language. Next, we adapted the traditional iterated learning paradigm [3] to experimentally investigate how the process of cultural transmission affects the likelihood of a word being conserved or vulnerable to change.

Our key findings supported the corpus analyses of cognitive processes: 1. Words that are high in frequency and short in length exhibit the least change in their forms; 2. Lexical replacements occur when words are lower in frequency and adjustments occur when words are long. 3. High frequency words are conserved in languages, even when undergoing cultural transmission. 4. The final part of the word is most susceptible to change. This experimental approach to studying how cognition influences language change will offer a means to empirically test predictions related to other structural and distinctive properties of human language.

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Typicality Effects in a lexical decision task and in a categorization task. Classical or renewed interpretation?

Angèle Brunellière, Emmanuel Farce, & Isabelle Bonnotte
Univ. Lille, CNRS, UMR 9193 - SCALab - Sciences Cognitives et Sciences Affectives, F-59000 Lille, France

Relearning after damage in connectionist networks highlighted that atypical items of their semantic category yielded more generalization than their typical members (Plaut, 1996). This result was confirmed in empirical studies (e.g., Kiran & Thomson, 2003). It seems therefore that atypical words, as a whole, provide more information about the overall structure of the semantic category thanks to their specific and shared features. Following this view, the processing of atypical primes would be more beneficial than the processing of typical primes, sharing many features with the members of the category, but providing little information about the variation between its members. In contrast, the classical perspective based on category verification tasks assumes that the processing of typical primes would facilitate the processing of other members of the category. It is thus less known about how the members of a category affect the recognition of other members.

The present study, conducted with French young adults, tested the classical perspective against the renewed one by leading two semantic priming experiments (166-ms stimulus-onset asynchrony) in either a visual lexical decision task (Experiment 1) or a visual categorization task ('same category' vs. 'different categories', Experiment 2). Both experiments contrasted four semantic priming contexts: typical and atypical related priming contexts, and their respective unrelated priming contexts, which were matched for lexical frequency and length. The typicality of the targets was also manipulated by contrasting eighty typical and eighty atypical targets.

Experiment 1 showed a target effect, with slower RTs on atypical targets than on typical ones. So, separate analyses were conducted by each type of targets. On atypical targets, a semantic priming effect was only significant, with a similar size with atypical primes (10 ms) and typical primes (12 ms). On typical targets, a semantic priming effect and a Semantic Priming Context x Prime Typicality interaction were significant, with a higher semantic priming effect with typical primes (27 ms) than with atypical ones (11 ms).

Experiment 2 highlighted higher percentages of errors on atypical targets than on typical ones, leading to separate analyses by each type. On atypical and typical targets, we observed a semantic priming effect and a Semantic Priming Context x Prime Typicality interaction. On atypical targets, there was a higher negative semantic priming effect with atypical primes than with typical ones (respectively, 37% and 23% of errors more than with the unrelated priming context). On typical targets, there was a significant negative semantic priming effect only for atypical primes (27% of errors).

Both experiments showed an advantage with the typical priming context, not with the atypical one. Our results do not support the conclusion raised by Plaut (1996) and Kiran and Thomson (2003), but reinforce the classical perspective. We will discuss our results with reference to semantic models.

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Modelling crosslinguistic differences in pronoun resolution

Heather Burnett & Barbara Hemforth, LLF, CNRS-Univ. Paris Diderot

An important current research question in psycholinguistics concerns the mechanisms through which different interpretations of superficially similar constructions can arise across languages. For example, Hemforth et al. (2010) observed cross-linguistic variation in sentences like (1). In German, listeners prefer to resolve the pronoun to the subject (also Bouma & Hopp 2007), while, in French, they are most likely to interpret the pronoun as referring to the object.

(1) a. The postman met the streetsweeper before he went home.
b. Le facteur a rencontré le balayeur avant qu'il rentre a` la maison.

Burnett & Hemforth (2017) propose a computational model of differences in pronominal resolution preferences between German and French active sentences within the RSA framework that takes into account differences in the inventory of syntactic constructions between them. The model predicts the patterns of pronominal reference observed in experiments based on a high prior probability of next mention of subjects (see Arnold 2001) and a higher cost for the Speaker producing the *avant que* construction for subject antecedents for which an alternative infinitival construction is available (*avant de rentrer à la maison*) in French but not in German. This paper extends this model to pronoun resolution in passive sentences. Colonna et al. (in press) and Schimke et al. (submitted) report experimental evidence that passives (2a) show a strong subject preference, although the alternative construction (2b) is also available.

(2) a. Marie a été appelé par Pierre avant qu'elle rentre à la maison / b. avant de rentrer à la maison.

c. Marie a appelé Pierre avant qu'elle rentre à la maison / d. avant de rentrer à la maison.
`Mary was called by Peter (called Peter) before she went home (before going home).'

We see two clear ways of incorporating these surprising results into the model:
i. Listener's priors for a subject being mentioned next increase for passives because they become very salient, topical antecedents (as Colonna et al suggest).
ii. The "avant de" alternative is less available to the Listener for passives because it is less frequent so that the cost for overt pronouns is reduced.

To distinguish between i. and ii, we carried out an acceptability study with comprehension questions (e.g. *who went home?*) comparing the 4 conditions in (2);(21 participants, 16 items, run on Ibex), participants chose about equally often the subject as an antecedent for actives as for passives: 84% for actives, 87% for passives. "Avant de" was marginally ($p<.09$) more acceptable for actives than for passives (8.60 out of 10 for actives, 8.2 out of 10 for passives). For both, actives and passives, the "avant de" construction was more acceptable than the "avant que" construction (actives: 8.6 vs 7.6; passives: 8.2 vs 7.7; all ps < .01) and there was a marginal interaction with actives showing a larger penalty for the "avant que" construction than passives ($p<.09$). Thus, the "avant que" construction may induce slightly lesser costs for passives contributing to the preference change, but the effects are not very strong. Therefore, increased priors for the subject being mentioned next following a passive seems to be the more probable candidate for the change in antecedent preference.

The processing of argument structure in light-verb constructions: a reading-time study

Alessandro Caiola
Sapienza University of Rome/Roma Tre University

Light-verb constructions (e.g. *to give a kick*) are a kind of complex predicates in which the action performed by the agent is expressed by an eventive noun or a prepositional phrase that constitutes the core of the predication, and the verb has a bleached semantics, conveying mostly grammatical informations (Gross, de Pontonx 2004). One of the peculiarities of most light-verb constructions is an asymmetry in the mapping of thematic roles on syntactic elements, as the syntactic subject is the agent of both the verb and the object. This asymmetry in the syntax-semantics interface – the so-called *Argument Sharing* (Baker 1989 Culicover & Jackendoff 2005, Butt 2010) – is of great theoretical interest, because it gives rise to a relationship between arguments and thematic roles that is no longer one-to-one. This phenomenon seems to be associated with an increase in the processing cost both in English (Piñango et al. 2006) and German (Wittenberg & Piñango 2011) that is delayed with respect to the onset of the target stimulus, pointing in the direction of a reanalysis of the sequence.

We conducted a self-paced reading task, in which Italian light-verb constructions and non-light constructions were contrasted. The reading time was measured on three regions of interest: the verb, the NP and the PP following the NP (e.g. *Marco ha dato*$_{[V]}$ *un calcio/libro*$_{[NP]}$ *a luca*$_{[PP]}$). We hypothesized a longer reading time for the light-verb condition, as the reader needs to reanalyze the sequence due to the non-canonical mapping of thematic roles on syntactic elements. Moreover, as this process seems to be delayed from the onset of the light-verb construction, we expect to find a more pronounced difference for the PPs than for the NPs. The results are in line with the expectations: the PPs were read slower in the light-verb condition, while there was no significant interaction between construction type and reading time for the NPs.

These results confirm what emerged from the previous behavioral studies on light-verb constructions, implying a different experimental paradigm and a different language. We interpret this as an evidence that – along with syntactic and semantic expectations – the reader/listener has expectations on the relationship between syntax and semantics, and therefore non-canonical mapping induces an augmented processing effort.

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Adaptation and coordination in dialogue

Lucia Castillo, Holly P. Branigan & Kenny Smith
PPLS, University of Edinburgh

How do speakers strike a balance between conservatism and innovation in successful communication? In linguistic communication, the need for coordination between speakers in a recurrent task is usually addressed through the use of conventions, where the repetition of the previously used choice or *precedent* by a speaker creates the mutual expectation of its subsequent use. This conventionalisation process can be explained as an instance of interactive alignment (Pickering & Garrod, 2004), where a speaker comes to use in the production of a sentence the same linguistic variant they heard in the comprehension of a previous utterance by their partner. As such, the establishment of a convention is a conservative process focused on the repetition of a previously used linguistic choice (Healey, 2004). However, adaptation to a changing context or a dynamic task might conflict with such a conservative strategy, and the need for coordination might drive the search for a better communicative alternative. Little is known about the mechanisms and processes that might allow for the change from an established convention to a new alternative. We use a variation of the maze game (Garrod & Doherty, 1994) to consider both how context affects the initial linguistic choice, and how established conventions might change as a result of interaction, addressing the interplay between conservatism and change in dialogue.

32 pairs and 64 individual participants had to describe figures and their positions while navigating one of two possible maze types: a regular maze, in which the grid-like structure of the maze is salient, or an irregular maze, in which specific points in the maze are salient. The same maze layout and the same figures were used in each of the 3 rounds, but the figures were placed in different locations each time. In the paired condition, participants interacted directly via a computer chat; in the individual condition they typed descriptions for an imaginary partner. The different maze layouts provided an initial context in which different types of descriptions would be better fits (concrete, idiosyncratic descriptions for irregular mazes and systematic, abstract descriptions for regular mazes), but the repetition of the task created an additional pressure for efficiency, favouring the use of abstract schemes. Pairs of participants, in the need to coordinate (i.e., to ensure mutual understanding), were expected to switch to abstract schemes, while individual participants (who did not need to coordinate with a partner) were not.

Both individuals and pairs were initially affected by the different maze layouts, using more idiosyncratic descriptions for irregular mazes and more systematic ones for regular mazes (Pairs $X^2(1)=7.7273$, $p=0.005$; Individuals $X^2(1)=3.7127$, $p=0.05$). However, only pairs of participants abandoned their unsystematic initial descriptions for a more systematic approach (i.e., abstract descriptions) as they moved through the game ($X^2(1)=17.962$, $p<0.001$) . Individual participants did not change to a more systematic approach. as the number of rounds played increased. We discuss these results in terms of an interplay between the forces of alignment and adaptation through interaction.

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Definiteness effect on attachment ambiguity resolution in L1 and L2: evidence from French

Daria Chernova, Anastasiia Generalova, St.Petersburg State University

Global ambiguity of modifier attachment to one of the nouns in a complex noun phrase (e.g. *the servant of the actress that was on the balcony*) has been a matter of cross- linguistic discussion since (Cuetos & Mitchell 1988). A number of factors, such as animacy, constituent length etc have been revealed, referentiality among them (Gilboy et al. 1995, Bezerra & Leitão 2016). However, these factors may affect parsing in L1 and L2 differently. We investigate the role of definite/indefinite article in attachment ambiguity resolution by native speakers of French and by Russian students learning French as a second language. We hypothesize that definiteness will be a guiding factor of ambiguity resolution by native speakers of French but not by L2 learners whose native language has no articles.

Method and participants. 20 native speakers of French and 40 native speakers of Russian learning French as L2 (levels from B1 to C1) performed a questionnaire task.

Materials and design. 24 sets of target stimuli, as in (1a-d), were constructed. In each sentence a complex noun phrase was followed by a RC, which could be attached either to the first or to the second NP equally plausible. Every participant saw each sentence once, in one of the conditions. Each sentence (including 36 fillers) was followed by a question (e.g. „Who had been in the accident?" in the set (1a-d)) and a participant was asked to type in the answer. All L2 learners were 98% accurate answering the questions to filler sentences.

(1) a. *Le journaliste avait interviewé un fils d'un colonel qui avait été dans un accident.*
journalist interviewed a son of a colonel that had been in the accident
b. *Le journaliste avait interviewé un fils du colonel qui avait été dans un accident.*
journalist interviewed a son of the colonel that had been in the accident
c. *Le journaliste avait interviewé le fils d'un colonel qui avait été dans un accident.*
journalist interviewed the son of a colonel that had been in the accident
d. *Le journaliste avait interviewé le fils du colonel qui avait été dans un accident.*
journalist interviewed the son of the colonel that had been in the accident

Results. The analysis of answers shows an overall preference for HA in both groups (both French and Russian prefer high attachment). Definiteness affects ambiguity resolution by native speakers – two-way ANOVA shows significant interactions between factors "N1 definiteness" and "N2 definiteness" (54% of HA in b-condition and about 70% in other conditions). However, it does not affect ambiguity resolution by L2 students – the distribution of answers is the same among 4 conditions.

Discussion. We argue that definiteness as an important discourse factor guides RC- attachment by native speakers of French: indefinite N1 and definite N2 provoke more LA- interpretations in RC-attachment. However, definite and indefinite articles are underspecified by L2 learners as definiteness is not grammaticalized in their native language.

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Feature Retrieval Cost and on-line/off-line complexity in clefts

Cristiano Chesi (NETS - IUSS Pavia), Paolo Canal (Scuola Normale Superiore, Pisa)

In Object Clefts (OCs, see (1)), it is crucial to resolve the dependency between the head ("the banker", (1.a)) and the lexical verb ("avoided", (1.a)) to comprehend correctly the sentence. This kind of dependency has been deeply studied both from the theoretical/competence perspective (Friedmann et al 2009, Belletti & Rizzi 2012 a.o.) and from the psycholinguistic/performance one (Gordon et al. 2001, 2004, a.o.), especially when an intervening "similar" DP (the subject of the cleft: "the lawyer" in (1.a) vs. "Dan" or "we" in (1.b)) is processed between the head and the lexical verb (Warren & Gibson 2005):

(1) a. it was [the banker]$_i$ that [the lawyer] avoided _$_i$ at the party
b. it was [the banker/Pat/you]$_i$ that [the lawyer/Dan/we] avoided _$_i$ at the party
c. it was [the/you banker]$_i$ that [the/you lawyer] avoided _$_i$ at the party

The goal of this work is twofold: on the one hand we want to provide another piece of evidence by testing more precisely person features (third (default) vs. second person as in (1.c)) when the "lexical restriction" (i.e. a full noun, Belletti & Rizzi 2012) is present; on the other, we want to evaluate the accuracy of a feature-based "complexity metric" (Feature Retrieval Cost, FRC, inspired to cue-based memory retrieval idea, Van Dyke & McElree 2006) that should predict the processing asymmetries in more precise and graded way compared to alternative approaches, eventually reconciling a formal theory of competence and the psycholinguistic performance revealed. In short, FRC provides a numeric measure (C_{FRC}) of the complexity on a specific segment triggering retrieval (e.g. the verb segment *x*) that is inversely proportional to the number of features unambiguously cued by the segment morphology (*dF*) and proportional to the number of features to be retrieved (*nF*) that are shared by other items in working memory (*m*):

$$C_{FRC}(x) = \prod_{i=1}^{m_x} \frac{(1+nF_i)^{m_i}}{(1+dF_i)}$$

New empirical evidence has been collected with this intent, comparing determiners and restricted pronouns in Italian (Italian versions of (1.c)) both on-line (eye tracking) and off-line (grammaticality judgment). 33 subjects (age range = 19-35) were enrolled in the on-line eye-tracking experiment. Other 48 subjects (age range: 20-64) were enrolled in the off-line grammaticality judgment experiment (web-based questionnaire to evaluate sentence acceptability on a 7-points Likert-scale) on the very same materials. We used mixed-effects regression models (Baayen et al 2008). Reading times data were analysed by fitting general linear mixed models, whereas (categorical) regression data were analysed by fitting mixed-effects logistic regressions (Jaeger 2008). Reading times were log-transformed to respect the normality assumption of mixed-effects regression models.

Accuracy and acceptability patterns ([simpler/more acceptable] art pro > art art ≥ pro art > pro pro [harder/less acceptable]) as well as the major asymmetries in fixation times/regressions revealed are predicted by the FRC function (Chesi 2015). The asymmetries are explained by the fact that pronouns (unlike articles) bear 2nd person features on the intervening subject triggering verbal agreement and FRC relies on the distinct featural person disambiguation cued by the verbal morphology.

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Aspectual coercion and underspecification in Slavic

[1]Chromý, Jan, [1]Matějka, Štěpán & [2, 3] Dotlačil, Jakub
[1]Charles University, [2]University of Groningen, [3]University of Amsterdam

Similarly to other Slavic languages, Czech has both grammatical (perfective: Pf and imperfective: Ipf) and lexical aspect (Filip, 2012). Moreover, Czech also has a relatively small group of so-called bi-aspectual (BA) verbs (Komárek, 2002). We provide experimental evidence that BA verbs can behave as either pf or ipf depending on context. Furthermore, our results show that the choice is not affected by lexical aspect and that BA verbs do not show a costly aspectual coercion. Both results strongly suggest that BA verbs are underspecified, not just ambiguous between two aspectual readings.

The hypothesis was tested in 3 SPR experiments. **Exp. 1** examined the differences in reading times (RTs) of sentences distinguished only by their main clause verb. Every verb appeared in one of three forms: a BA verb (e.g. akceptovat 'to accept'), its Pf equivalent (e.g. přijmout 'to accept'), or its Ipf equivalent (e.g. přijímat 'to accept'). The verbs were followed by a sg. object and the phrase *velmi dlouhou dobu* 'for a very long time'. The phrase is (to a large extent) compatible with ipf verbs and incompatible with pf verbs (cf. Filip, 2004). The verb form was crossed with the second experimental manipulation, lexical aspect: either durative or punctual predicates were used. This was done to test aspectual coercion hypothesis (e.g. Piñango, 2006), which predicts that punctual verbs would yield processing difficulties when combining with for-phrases, since the predicates would have to be coerced to their non-punctual (iterative) interpretation. All verbs in the exp. 1 were transitive and were in past tense. We found significantly higher RTs on the last word of the for-phrase in sentences with Pf verbs compared to sentences with Ipf or both types of BA verbs. No effect of punctual vs. durative manipulation was observed. The results indicate that BA verbs can be readily understood as Ipf and this is why they, in contrast to Pf verbs, do not show processing difficulties with for-phrases. This conclusion was strengthened by the results of **Exp. 2**. In that experiment, verbs had pl. objects and were followed by *dokud* 'until' clause which is compatible only with Ipf verbs (cf. Dočekal, 2012). The only significant effect observed was increased RTs for Pf verbs on the *dokud* 'until*',* compared to both Ipf and BA verbs. To exclude the possibility that BA verbs just behave as Ipf verbs, we tested BA, Pf and Ipf verbs with *až* 'when' clauses (**Exp. 3**) which are incompatible with Ipf verbs (Veselý, 2008). In the exp. 3, verbs appeared in the subordinate *až* 'when' clauses. The verbs were in present tense (as is required by *až*) and had sg. objects. The RTs were significantly higher on the Ipf verbs and two following words in comparison to sentences with Pf or BA verbs. As in the exp. 1 and 2, lexical aspect did not play any role.

These experiments clearly demonstrate that BA verbs in Czech are truly bi-aspectual, that is, they are neither solely Ipf or Pf, providing novel evidence that such a class exists in Slavic (cf. Zinova and Filip, 2015, on some problems in establishing this class). Second, it is unlikely that the verbs are ambiguous between two aspects. If they were, we would expect that a parser would commit to one aspectual meaning (cf. Frazier and Rayner, 1990), treating punctual verbs as Pf and durative verbs as Ipf. Yet, the lexical aspect does not affect the processing of constructions with BA verbs. The lack of role of lexical aspect can then be explained as follows: BA verbs remain underspecified and can be combined with for-phrases and until/when clauses irrespective of the durative/punctual distinction. This underspecification supports the position of Bott and Hamm (2014) that aspectual coercion is modulated by grammatical means, but crucially, it supports it within one language (previously, this has been supported only by cross-linguistic studies).

The influence of lexical priming versus event knowledge on the N400 and the P600

Francesca Delogu, Harm Brouwer, Matthew W. Crocker
Saarland University

In online language comprehension, the N400 component of the Event-Related Potentials (ERP) signal is inversely proportional to semantic expectancy (Kutas & Federmeier, 2011). Among other factors, a word's expectancy is influenced by both lexical-level (Bentin et al., 1985) as well as event-level (Metusalem et al., 2012) priming: the N400 amplitude is reduced if the eliciting word is semantically related to prior words in the context and/or when it is consistent with the event being described. Perhaps the most extreme instance of such facilitatory effects arises in the processing of reversal anomalies (see Brouwer et al., 2012 for review). Here, a word that renders a sentence semantically anomalous, such as "eat" in "*For breakfast the eggs would eat*", produces no difference in N400 amplitude relative to a non-anomalous control "*For breakfast the boys would eat*" (Kuperberg et al., 2007). Indeed, the absence of an N400-effect for contrasts such as these suggest that the critical word *eat* is equally facilitated in both the target and the control condition. An open question, however, is whether these effects are predominantly driven by lexical-level or event-level priming.

To address this question, we conducted an ERP experiment in which we explicitly deactivate the event under discussion in order to mitigate event-level priming effects on the critical word. Target words (e.g., *menu* in the example below) appeared in contexts (a) promoting the activation of associated event knowledge (e.g., *entering a restaurant*) vs. contexts (b) promoting the "deactivation" of such knowledge (e.g., *leaving a restaurant)* vs. contexts (c) activating unrelated knowledge (e.g., *entering an apartment*).

a. John entered the *restaurant*.
b. John left the *restaurant*.
c. John entered the *apartment*.
Target: Before long he opened the menu […].

In the control condition (a), the target word *menu* is both primed lexically (through *restaurant*) as well as continuing the unfolding event (opening a menu is a typical activity in a restaurant). In (c), by contrast, *menu* is neither primed lexically nor through the mentioned event, and as expected (c) produced an N400-effect relative to control. In (b), *menu* is primed lexically, but the *restaurant*-event is deactivated. Crucially, (b) produced no difference in N400 amplitude relative to (a), suggesting that facilitation for *menu* is predominantly driven by lexical-level priming. This is further supported by the fact that condition (b) elicited a P600-effect relative to (a) (cf., Kuperberg et al., 2007), which we take to index difficulty in integrating the word *menu* into the unfolding representation of the event, and hence as evidence that the *restaurant*-event was indeed deactivated. The N400/P600 pattern in our semantically anomalous, but lexically primed, condition (b) aligns with previous findings for reversal anomalies. We take this as evidence that the P600 – not the N400 – indexes process of semantic integration, while facilitatory effects in the N400 are predominantly driven by priming, consistent with the Retrieval-Integration account of language electrophysiology (Brouwer et al., 2012).

Bentin et al. (1985), *Electroen. Clin. Neuro.*; Brouwer et al., (2012), *Brain Res.*; Kuperberg et al. (2007), *Brain Lang.*; Kutas and Federmeier (2011), *Annual Rev. Psych.*; Metsulem et al., (2012), *JML*.

Evidence of Transfer of the L1 Model of Bilinguals on L2 in Reading

V.A. Demareva[1], A.V. Polevaia[1], S.A. Polevaia[1,2]
[1]Lobachevsky State University, [2]State Medical Academy
Nizhni Novgorod, Russia

Eye movement research provides significant insight into the cognitive mechanisms of the reading process. Psychophysiological studies show that processing of context and functional words (FW) suggests different mechanisms, which are still not clear. Part of the problem is the fact that there is no data about the features of reading the FW in L2, and their relationship to the level of individual's language training.

We investigated two types of language profiles: bilingual (Russian and English) and L1 (Russian). 22 bilingual students and 11 L1 students with Elementary English language skills participated in the experiment. We used question texts from the common L2 proficiency tests as stimuli. Recording of eye movement data was carried out using SMI Hi-Speed.

When analysing the presence/absence of fixation on FW it was revealed that bilinguals skip 67% of the words, and L1 students - 52%. It was revealed that the factor of language profile significantly affects (see figure):

a. the duration of the first fixation on the FW ($p < .001$);
b. the total dwell time on the FW ($p < .01$);
c. the average fixation duration on the FW ($p < .001$);
d. the number of fixations on the FW ($p < .05$).

All in all, the bilinguals make less and shorter fixations on the FW than the L1 students.

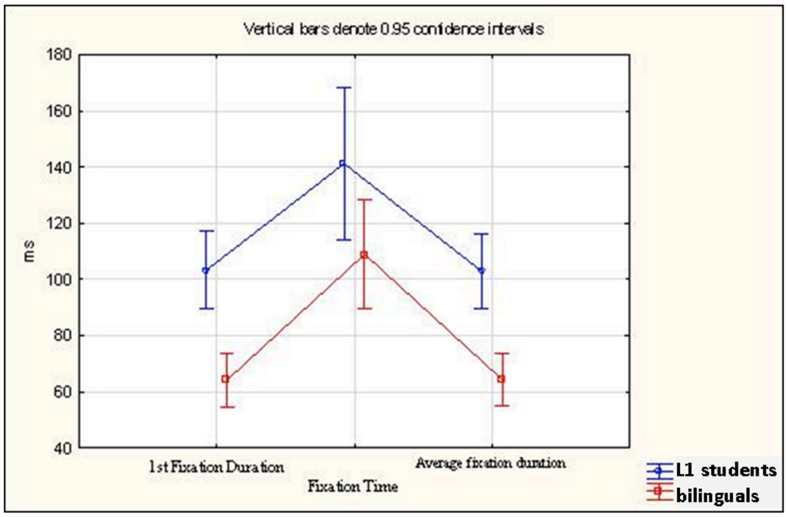


Figure. Fixation parameters in L1 students and bilinguals during reading FW

Thus, we found that the bilinguals use similar model in L2 reading as in L1 reading. The above confirms an earlier assumption that during professional learning of L2 there is a transfer of the model of language processing in L1 to L2.

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Turkish Speakers' Use of Prosody in Producing and Processing Morphological Ambiguities

Nazik Dinçtopal Deniz, Boğaziçi University

Background: This study investigates word pairs in Turkish that are globally ambiguous as to the morpho-syntactic function of the homophonous morphemes/morpheme combinations involved in them. Previous research has shown that prosody can provide acoustic cues in lexical competition (Davis et al., 2002) and assists in predicting morphological complexity (Kemps et al., 2005) informing on its role in lexical representation and access. Investigating use of prosody in morpho-syntactic ambiguities in a morphologically rich language such as Turkish can shed light not only on the role of prosody in lexical representation/access but also on its interaction with syntactic derivations.

Method: Fifty-four volunteers participated in two production (read-aloud) and two perception (lexical decision) experiments. Morphologically ambiguous noun/verb pairs (disambiguated in the sentential context) that either contrasted for stress (*konu-ş-**má*** topic-DER-DER 'speech' vs. *ko**nú-ş**-ma* topic-DER-NEG 'don't talk') or not (*giz-**lér*** secret–PL 'secrets' vs**.** *giz-**lé-r*** secret-DER-AOR '*pro* hides') were used. Potentially ambiguous pseudo-words were also included to test for productive use of prosody and morphology. In the production tasks, participants simply read aloud the sentences. In the perception tasks, they made a lexical decision on the last word, the morphologically ambiguous word, which had either matching (N or V) or mismatching (V or N) prosody.

Results: Mixed effects linear regression models were used in the analyses. Results of the production experiments showed for both words and pseudo-words that the participants placed stress on the final syllable for nouns and on the penultimate syllable for verbs for the stress-contrasting pairs (*t*'s > 6.48). For the non-contrasting pairs, final syllable duration was longer for nouns than verbs; again for both words and pseudo-words (*t*'s > 2.7). Results of the perception experiments showed that participants were sensitive to F0 differences in the stress-contrasting pairs (*t*'s > 2) but not sensitive to durational differences in the non-contrasting pairs neither for words nor for pseudo-words (*t*'s < 1.41) which could potentially be due to duration being a less robust cue than F0 in Turkish (Levi, 2005).

Conclusion: These findings suggest that Turkish speakers use prosodic information to disambiguate morphologically ambiguous pairs as they speak and they are sensitive to such acoustic cues (at least stress) when they hear them; and they do so not on the basis of individual word knowledge but productively, through computation of morpho-syntactic rules.

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The Top-Down and Bottom-Up of Relative Clause Processing

Julia Edeleva[1]; Valeria Demareva[2]
[1]University of Braunschweig; [1]Universty of Münster; [2]Lobachevsky State University of Nizhni Novgorod

The focus of the contribution is the well-attested phenomenon of the Subject/Object Asymmetry in relative clause processing whereby ORCs cause greater processing difficulty than their subject extracted counterparts. Still, the subject advantage is not equally pronounced across different languages. In the current visual world paradigm, the eye movements of French and German speakers were being tracked while they were exposed to a subject (*Where is the cat that is feeding the hedgehog?*) or an object RC (*Where is the cat that the hedgehog is feeding?*) in their native language. In the French study, two possible ORC types (with the NP-V and the V-NP word order) additionally were contrasted. On the next display, one of the referents from the first visual display was presented again. With the pre-programmed "YES"/"NO" keys, the subject was to decide whether the referent in the second display was the same as questioned by the auditory stimulus. Reaction times and response accuracy were measured.

The results confirmed the presence of the Subject/Object Asymmetry in French and the absence thereof in German (at least in temporal terms), which is in line with the previous findings for both the languages ((1); (2); (3)). While German native speakers diverted their attention to the designated referent straight at the relative pronoun onset both for the SRC and the ORC, French native speakers displayed a well-pronounced subject relative clause advantage. Additionally, inverted ORCs with a non-canonical word order (VNP) caused greater processing penalty than their NP-V counterparts in French.

The crucial finding of the current study is an increase in the proportion of looks towards the middle referent (the hedgehog) in French ORCs with the NPV word order starting at the RC verb and into the RC offset. Arguably, while processing complex structures the parser does not always operate on a complex unit such as the whole of the relative clause, but on its integral parts (*the hedgehog is going to feed*). Since no such tendency was witnessed for the ORC with the VNP word order or for the SRC, we will conclude that, to be eligible for lower-level analysis, the segment needs to be locally coherent and constitute a well-formed unit of a language.

The proportion of looks towards the middle referent remained low for either relative clause type in German, with only a marginally significant increase at the RC offset in ORCs. Supposedly, constructing a relative clause representation in real-time, the parser resorts to different processing cues for French and for German. French native speakers seem to be assembling a relative clause from less complex locally coherent constructions (e.g. a subject-verb unit "*le hérisson va probablement nourrir?*") in a bottom-up fashion. By contrast, a German native speaker makes extensive use of top-down knowledge of subordinate clauses (e.g. their V-last word order) and activates an empty fully-fledged representation of a relative clause, which is filled with the upcoming input. The way speakers differ in their use of language-specific cues while processing complex structures can potentially explain the non-universal character of the Subject/Object Asymmetry.

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Two orthographies in one brain: How flexible are bilinguals' reading styles?

Ciara Egan[1], Kristina Moll[2], Chris Saville[1], Manon Jones[1]
[1]Bangor University [2]Ludwigs Maximilians Universität

Psycholinguistic grain size theory posits that languages with opaque grapheme-to-phoneme spelling systems are read using larger-unit processing than is the case with more transparent languages (Ziegler & Goswami, 2005). But little is currently known about the reading style of bilinguals who are fluent in both an opaque and a transparent language. Does reading style adapt to the language context? Or is reading style driven by visual input? Here, eye movements were recorded whilst highly fluent, balanced Welsh-English bilinguals (n=20) were presented with sentences in Welsh and English, constituting transparent and opaque orthographies, respectively (see Figure 1). Each sentence contained either a Welsh-English cognate word or a pseudocognate derivative (e.g., symbol – sumbot). Eye movement data was analysed using LMM, in which participants' daily use of Welsh/English was included as a random effect, along with participants and items variables. On first pass measures, cognates and pseudocognates in Welsh sentences elicited longer fixations than in English, suggesting an initial smaller unit processing approach in the transparent language. On reanalysis measures, an interesting lexical effect emerged: Cognates presented in Welsh sentences specifically elicited a higher number of total fixations, and longer regression paths than was the case for pseudocognates. But no appreciable differences were found in English. Taken together, our findings suggest that bilinguals adapt their processing style according to the language context, even when the visual input is identical.

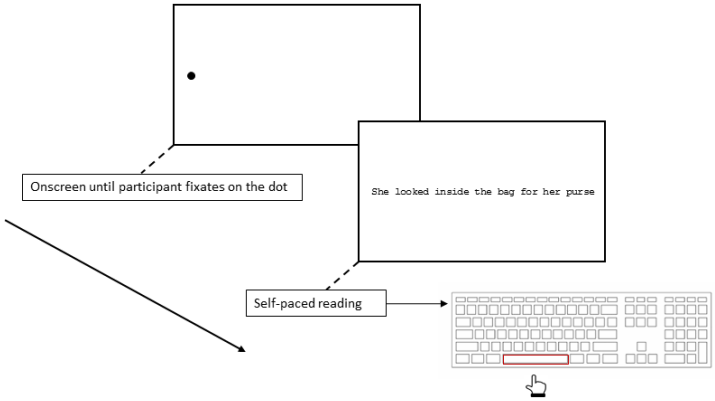


Figure 1. Schematic of experimental procedure.

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Serial or parallel dual-task language processing: Production planning and comprehension are not carried out in parallel

Amie Fairs[1], Sara Bögels[2], Antje S. Meyer[1,2]
[1]Max Planck Institute for Psycholinguistics, [2]Donders Institute, Nijmegen, Netherlands

In conversation, people engage in the dual-task of comprehending and planning speech. However, dual-tasking research has rarely used paradigms with two linguistic tasks. Here, we tested whether there is greater interference in performance with two linguistic tasks, compared to a linguistic/non-linguistic dual-task. We also investigated whether the amount of parallel processing depends on whether participants react overtly in both tasks or only in one of them.

In Experiment 1, task one was syllable (linguistic) or tone (non-linguistic) identification, and task two was picture naming with written (semantically related or unrelated) distractors. SOAs between the syllable/tone and picture onset were 0ms and 1000ms. Participants responded to both tasks (button press and speaking, respectively). In Experiment 2, a task choice paradigm was used. Participants first heard the syllable/tone and then saw the picture and distractor. When a low tone/'low' syllable was played, participants named the picture; when a high tone/'high' syllable was played, participants read the distractor word aloud. Again, two SOAs of 0ms and 1000ms were used. Previous research using only the tone condition (Piai, Roelofs & Schriefers, 2015) found an interference effect at SOA 1000 but not at SOA 0. This pattern indicates that at SOA 0 (but not at SOA 1000), the two tasks are carried out in parallel and the semantic interference effect is absorbed into the slack period of task one processing. We sought to replicate this pattern, and see if the same results were found when both tasks were linguistic. The same pictures and words were used as in Experiment 1.

In Experiment 1, we found semantic interference at both SOAs in both the syllable and tone conditions. Thus, when the task 1 stimulus is responded to overtly, the tasks are carried out serially. Additionally, there was a significant SOA by syllable/tone condition interaction: Naming latencies were slower in the syllable condition than in the tone condition at SOA 0, but not at SOA 1000. This indicates that there was some extra (non-semantic) interference in the syllable condition.

In Experiment 2, we replicated the SOA by syllable/tone interaction found in Experiment 1. In addition, we found semantic interference in all conditions, which indicates that participants engaged in serial processing in all conditions. We did not replicate the interaction of SOA and relatedness seen by Piai et al. (2015), which had pointed towards parallel processing of tones and pictures. Our results and those of Piai et al. (2015) suggest that participants in the task choice paradigm may choose to adopt a serial or parallel processing strategy.

Overall, our results show that an identification or decision task and naming with distractors is processed in a serial manner, regardless of whether that task is linguistic or non-linguistic. Additionally, we found longer naming latencies at SOA 0 in a dual-linguistic task than a linguistic/non-linguistic dual-task, suggesting that there is some extra interference when carrying out two linguistic tasks, which is not related to semantic interference.

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Adjustment of speaker's referential choices in a collaborative storytelling in sequence task: Effects of discourse stages and referential complexity

Marion Fossard, Lucie Rousier-Vercruyssen & Sylvia Gonzalez (Université de Neuchâtel, Switzerland), Amélie M. Achim (Université Laval, Québec, Canada)

Introduction: During narrative discourse, the different referent accessibility is rarely fixed once and for all. Rather, it varies as the discourse unfolds, depending on the presence and prominence of the other referents. This leads speakers to adjust their referential choices to the accessibility level of the referents. Previous research showed that the referential choice between full and reduced forms depend on the discourse status of the referent, with full noun phrases (NPs) used to introduce new referents or to shift to a different referent, and pronouns used to maintain a referent in focus. This basic dichotomy between full and reduced forms is however a bit myopic, and further levels of granularity (i.e. looking at the full referential forms) may provide additional insights. In particular, reference content (i.e. amount of information provided in the NP) could vary as a function of the referential complexity levels of the narration. Yet, little is known about how people adjust their referential choices when they refer to more or less accessible referents in increasingly complex referential contexts. The purpose of this study is to investigate these choices during a continuous discourse (a storytelling) through an analysis of both reference markers and reference content (e.g. "the blond girl" vs. "the girl").

Method: 30 French speakers were administered a storytelling in sequence task. They had to tell 9 stories to a partner, so that the latter could reorder correctly the six pictures making up each story. The task was designed such that specific discourse stages could be identified, corresponding to the introduction, maintaining or shift of the character in focus (i.e. visually salient and active in that image). The task also included a manipulation of referential complexity, which was implemented between the stories by manipulating the number of characters (1 vs. 2) and for stories with 2 characters their ambiguity in gender (different vs. same). For each image of each story, the referential expression produced to refer to the character in focus was extracted and coded for: 1) the choice of reference marker (indefinite, definite, pronoun) and 2) the reference content (modified vs. unmodified) which we examined specifically for the definite NPs. We hypothesized that specific reference markers would be prominent at the different discourse stages, and that an effect of referential complexity would emerge for the reference content, with more modified NPs expected with increased complexity.

Results and discussion: Results confirmed a strong effect of discourse stages on reference markers such that indefinite markers were more often used to introduce the characters, pronouns were more often used to maintain the character in focus and definite markers were more often used to shift to a different character. The number of characters (1 vs. 2) influenced the choice between pronouns and definite markers specifically during the maintaining stage, such that pronouns were almost exclusively produced in stories with one character, whereas definite references (mainly unmodified NPs) sometimes replaced them when there were 2 characters. In contrast, gender ambiguity influenced the definite expression content during the shift stage, modified NPs being more often used when the characters had the same gender, whereas unmodified NPs were more often used when they had different genders. Beyond the expected effects of discourse stages on reference markers, the number of characters and their ambiguity in gender also modulated speaker's referential choices at specific discourse stages through adjustments of reference content, likely to facilitate recognition of the intended referent by the addressee.

Relationship between phonology, prosody and reading skills

Tess S. Fotidzis, Ph.D. Student, Literacy Studies Ph.D. Program, Middle Tennessee State University;
Cyrille L. Magne, Ph.D., Psychology Dept. & Literacy Studies Ph.D. Program,
Middle Tennessee State University

Vocal tone, or prosody, helps to convey the meaning of speech beyond the actual spoken words (e.g., Sammler, Grosbras, Anwander, Bestelmeyer, & Belin, 2015). That is, the intonation, rhythm, and stress of spoken language—i.e., the suprasegmental features of phonology—have been implicated to facilitate language comprehension (Bolinger, 1986). Increasing empirical evidence supports a link between prosodic sensitivity (PS) and reading skills, and suggests PS may be predictive of later reading outcomes (e.g., Holliman, Sheehy & Wood, 2012). However, the role of PS in reading comprehension has not been well established. Likewise, research remains sparse on the interactions of the neurocognitive systems underlying the components of prosody (e.g., see Ashby & Clifton, 2005; Wade-Woolley & Wood, 2006; Whalley & Hansen, 2006), and reading.

As such, this study addresses this specific dearth of research, on the more "novel"—albeit equally important—component of prosody, known as intonation. We used event related potentials (ERPs) during two forced-choice speech perception tasks, combined with behavioral assessments, to examine the relationship between PS, phonological processing (PP), and reading skills.

In particular, we examined how the prosodic form of an utterance (i.e., intonation) changes its meaning (e.g., Bolinger, 1986; Sammler et al., 2015). That is, how do the rising and falling pitch contours in spoken language (i.e., questions ([pear**?**] vs. statement [pear**.**], respectively), differentially facilitate language processing? Additionally, we investigated the relationship between PS and PP by manipulating the voice-onset time (VOT) of specific phonemes in the spoken words, which allows for contrasting of the phoneme stops (/*b*/ as in [ˈb̥ɛ(ə)r]) vs. /*p*/ as in [ˈpʰɛ(ə)r]).

Our protocol was adapted from Sammler and colleagues (2015), that used fMRI and gave specific hypotheses regarding *where* in the brain these processes would occur. Thus, by including EEG, we can also identify *when* these processes take place, and can relate the brain circuitry involved in the various aspects of phonology, and the different components of reading skills.

Based on the evidences in the literature, prosody tasks tend to be right lateralized processes, while other language-related processes trend towards left lateralization. Therefore, we predict there will be correlations between the performances on the discrimination tasks and participants' brain responses. We also predict that the level of brain activity and performance will positively correlate with the task, such that larger brain responses will correlate with the reading measures.

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Probablistic Use of High Frequency Marker Words Helps Language Acquisition

Rebecca L. A. Frost, Lancaster University, UK
Padraic Monaghan, Lancaster University, UK
Morten H. Christiansen, Cornell University, USA

High-frequency words have been found to benefit speech segmentation (Bortfeld, Morgan, Golinkoff, & Rathbun, 2005) and grammatical categorisation (Monaghan, Christiansen, & Chater, 2007), with recent research suggesting learners may be able to draw on these cues for both types of task at the same time (Frost, Monaghan & Christiansen, 2016). For instance, in English "*the*" occurs frequently, punctuating sequences of words in speech, and "*the*" also reliably precedes nouns – thereby providing grammatical category information, while also possibly assisting segmentation. Previous studies have tested the effect of high-frequency words on language acquisition by presenting them reliably within the experimental language, however natural language contains noise and variability that may provide further opportunities for robust learning (Monaghan, 2017). We tested the effect of variability on learning by familiarising adults with continuous speech comprising repetitions of target words, which were preceded by one of two high-frequency marker words 100%, 67%, or 33% of the time, with marker words distinguishing targets into two otherwise unidentifiable categories.

Participants completed a 2AFC *speech segmentation* task, and a similarity judgement *categorisation* test, followed by a *cross-situational word learning* task where target words from the training speech were mapped onto actions and objects depicting two different grammatical categories (nouns and verbs), presented across multiple trials. Critically, labelling was either consistent or inconsistent with the distributional categories (between subjects), to examine whether learners drew on the statistics of the input during subsequent language use. Participants also completed a *vocabulary* test, which assessed which mappings they had learned. There was a clear advantage of variability, with the 67% group performing best on measures of segmentation (100%: M = .62, SE = .03; 67%: M = .71, SE = .03; 33%: M = .67, SE = .02) and categorisation - giving significantly higher similarity ratings to test pairs containing items from the same (M = 3.80, SE = .17) versus different (M = 3.62, SE = .16) grammatical categories (t (23) = 2.194, p = .039). Data from the vocabulary test indicated that all conditions were better able to map target words onto nouns (overall M = .693, SE = .03) than verbs (overall M = .59, SE = .03, t (71) = 3.146, p = .002), but trends in the means indicated learning of verbs was better when target words labelled nouns and verbs in a way that was consistent (M =.63, SE = .035) rather than inconsistent (M = .55, SE = .038) with the distributional category distinction (though this difference was not significant, t (70), 1.461 p = .149). The data indicate that variability can help learners draw on the same high-frequency words during speech segmentation and grammatical categorisation. Further, findings suggest high frequency marker words denoting distributional categories may be especially helpful for learning of verbs.

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Which Individual Differences in Second-Language Learning Correlate with the Tip of the Tongue Phenomenon?

Teresa Garrido-Tamayo and Joaquín Gil-Badenes, Faculty of Psychology, UNED

Tip-of-the-tongue states (TOTs) are often encountered by speakers of more than one language who experience a temporary inability to retrieve a known word, accompanied by an intense feeling of imminent recall and the capacity to retrieve partial, accurate information about its semantic, syntactic or phonological features, such as meaning, grammatical gender, or first phoneme (Brown, 1991). The greater rate of TOTs in the growing multilingual population could be explained by lower second language (L2) proficiency levels (Borodkin & Faust, 2014) and later ages of L2 acquisition (Kreiner & Degani, 2015), along with less frequent use of each of their two languages (Gollan & Brown, 2006; Gollan, Montoya & Bonanni, 2005), and activation of both languages during processing in one language (Gollan & Acenas, 2004; Gollan, Ferreira, Cera & Flett, 2014). In an attempt to further previous research on the individual characteristics of L2 learning that are associated with a higher incidence of TOTs in bilingual (or multilingual) speakers, this study explored to what extent the set of three predictor variables –L2 proficiency, exposure, and preference of use– could significantly predict the frequency at which TOTs occur (i.e. the criterion variable) and the relative importance of these three variables in doing so. 30 native Spanish-language adult speakers, who had acquired English as an L2, completed a language experience and proficiency questionnaire and participated in a naming-to-definition task designed to elicit TOTs, based on 25 frequently-used common English nouns. The collected data was analysed using Pearson correlation and multiple regression analysis. Results show a negative correlation between TOTs and both English exposure and proficiency, likewise with the capacity of English proficiency to predict variability in TOT rates. No significant correlation was detected between preference to speak and read in English compared to Spanish and TOT occurrence. The substantial value of accurately and consistently retrieving words in daily communicative scenarios means that a greater understanding of the individual bilingual experience factors involved in these frustrating everyday naming difficulties is paramount to avoid the compromise of effective communication arising from increased reaction times, pauses, paraphrases and circumlocutions, and to contribute to the development of educational practices based on compensatory strategies that might prioritize relevant variables, such as L2 proficiency or immersion in environments where this language is spoken.

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Pronoun interpretation in Brazilian Portuguese: event structure can override subject-preference

Mahayana C. Godoy & Matheus A. Mafra (Federal University of Rio Grande do Norte)
mgodoy@cchla.ufrn.br

Sentences like the ones below have been used in completion tasks to show that, in English, pronoun-prompts (e.g., a) lead to more source-bias continuations than full-stop sentences (e.g., b) [1], that imperfective contexts decrease the amount of continuations biased towards the goal by focusing in an ongoing event [2], and that the coherence relations established between sentences may guide pronoun resolution [2].

(a) Rodrigo served/was serving the cake to Caio. He _____
(b) Rodrigo served/was serving the cake to Caio. _____

We ran two experiments to test if these results would hold in Brazilian Portuguese (BP). First, 48 BP native-speakers completed sentences in perfective and imperfective conditions like (a). Two trained judges categorized the responses by coherence relation and annotated whether pronouns were interpreted as referring to goals or sources, following parameters set in a previous work [2]. The results indicate that verb aspect has a similar effect in English and BP: more goal continuations were found following perfective sentences. However, our results show a significant preference for goals over sources in perfective contexts. This differs from previous works in English which found a 50/50 distribution for goal interpretations in this context, a trend usually explained on the basis of a subject-preference instantiated by pronouns [1]. When completions were broken down by coherence relations, the distribution of pronoun interpretation resembled the one observed in English, indicating that although the effect of a subject-preference in pronoun-prompt may differ cross-linguistically, coherence relations may have a more homogeneous role in guiding pronoun interpretation in different languages.

To test if the presence of pronouns in BP leads to subject-preference, 64 participants completed sentences with pronoun-prompts like (a) and full-stops like (b). For pronoun-prompts, we replicated the findings in experiment 1. Results from the full-prompt show a goal-bias for perfective and imperfective contexts and a preference to use names to refer back to goals, and pronouns (null and overt) when referring to the subject/source of previous sentences. This tendency to use pronouns to refer to sources only holds for the subset combining overt and null pronouns, but not for overt pronouns alone.

We argue that these results indicate that pronouns in BP, as in English, do increase the probability to refer to the subject of a previous clause (experiment 2), although somehow this constraint can be overridden in BP by event representation (experiment 1). We attribute this weaker effect of subject-preference in BP to cross-linguistic differences in pronoun distribution, probably due to the use of null pronouns in BP to refer exclusively to the subjects/sources (but not the goals) of previous sentences. Another reason why we think this is the case comes from the analysis of coherence relations in both languages. We argue that a similar result for English and BP in goal/source distribution when coherence relations are controlled supports the view that these relations are the primary factor in generating expectations about which referent will be mentioned next.

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Gender representation and processing in Russian-German bilinguals

Oleksandra Gubina & Johannes Gerwien
Heidelberg University

Previous research on the representation of grammatical gender in the L1 mental lexicon suggests that gender is stored at the lemma stratum. All nouns of the same gender category are connected to one abstract shared gender node (cf. Roelofs 1992). However, despite quite a few studies on gender processing in L2 comprehension (cf. Paris & Weber 2004, Lemhöfer et al. 2008, Hopp 2013) the question of how gender is represented and processed online in bilinguals whose L1 and L2 are both gender marking languages has not received a definite answer yet. Do nouns in both languages share the same abstract gender nodes? Can gender be activated from one language to the other? We here investigate this by looking at predictive processing of gender agreement in the visual world paradigm.

Fifteen advanced to near-native adult L1 Russian speakers of L2 German (critical group) and 15 native speakers of German (control group) were presented with visual stimuli, each of which showed three different objects. In all trials, all participants heard a German sentence fragment (e.g., ”dieser$_{[DET\text{-}MASCULINE]}$ schwarze$_{[ADJ]}$ Computer$_{[NOUN\text{-}MASCULINE]}$” ‘that black computer’), which, according to the instructions, cued them to click on the object that corresponded to the noun mentioned (target). Half of the stimuli (critical condition) were constructed in such a way that the name of one of the two non-target objects in the L2ers L1 (Russian) was congruent with the gender information encoded in the determiner (gender-congruent L1 competitor). The third object’s name was not gender-congruent in neither language (distractor). In the other half of the trials (control condition), neither a gender-congruent L1 competitor nor a gender-congruent L2 competitor were present in the display. Determiners and target nouns were always only gender-congruent in the bilinguals’ L2 (German). In all trials, the onset of the determiner was at 1600 ms and the onset of the noun at 3400 after trial onset. Trials from both conditions were individually randomized.

Growth curve analysis (Mirman 2014) focused on target and gender-congruent competitor fixation proportions over time. No differences between groups were detected in the control condition: L1ers and L2ers clearly anticipated targets, which suggests that participants were able to efficiently match gender information derived from the determiner with gender information associated with the object names. However, in the critical condition, L2ers showed more attention to gender-congruent competitors and arrived later at targets compared to the L1 control group.

Taken together, these results suggest that in advanced to near-native L2ers whose L1 has a similar grammatical gender system as their L2, gender is represented by shared abstract gender nodes, which can be activated by linguistic cues, such as determiners in language comprehension.

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Before or after? Suffixes outperform prefixes in discrimination of L2 categories

Dorothée B. Hoppe & Jacolien van Rij, University of Groningen; Michael Ramscar, University of Tübingen

Computational simulations of category learning illustrate that category relevant features are better discriminated from irrelevant features when during training, many cues predict few outcomes (Ramscar et al., 2010) because only then, error-driven discrimination learning is triggered. This finding can also be transferred to learning of linguistic categories, which can either be marked by a preceding marker (prefix) or a succeeding marker (suffix). As nouns are feature richer cues than prefixes or suffixes, marking with suffixes should be more effective for the learning of respective categories than marking with prefixes. In fact, findings from artificial language learning experiments show that nouns sharing a suffix are perceived to be more similar to each other than nouns sharing a prefix (Ramscar, 2013) and that category membership of nouns is better learned with suffixes than with prefixes (St Clair, Monaghan, & Ramscar, 2009).

Besides the hypothesis that in general, suffix marking should be more beneficial for category learning than prefix marking, we further investigated how the characteristics of feature sets determine which type of marking is needed for successful category discrimination. For this, we built an artificial language in which nouns were distributed across four categories. Categories were either consistent in a simple, well-known semantic category feature, in a complex, less obvious acoustic feature (stress), consistent in both features or inconsistent in both. Applying the computational model from Ramscar et al. (2010) to these materials, we predicted that only discriminative suffix learning can correctly discriminate relevant from irrelevant features in complex feature sets. For simple feature sets, our model did not predict a difference in learning as there, discrimination learning is not required for successful category learning.

We tested these predictions in three behavioral experiments in which participants implicitly learned to associate images with acoustically presented sentences. Depending on the condition, categories were marked by prefix and suffix or only by prefix. An analysis of grammaticality judgments of sentences with novel nouns revealed that the complex acoustic feature was only learned when suffixes were present during training. We also found an advantage of suffix marking for the simple semantic features; however, also with prefix only marking, categorization performance was above chance level.

The results from our simulation and experiment demonstrate that detailed temporal aspects of the input sequence as well as the complexity of feature sets determine the type of learning that will take place and therewith the learning outcome. Suffixed category marking allows learners to focus on category relevant features and to ignore irrelevant features. From this, clear implications for the design of L2 teaching material can be derived. Beyond that, our findings may also shed light on how a pressure for learnability could contribute to the emergence of succeeding as opposed to preceding category marking in a language.

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Acquisition and Long-Term Retention of New Meanings for Known Words

Rachael C Hulme, Daria Barsky, and Jennifer M Rodd
University College London

Adults often learn new meanings for words already present in their mental lexicon, for example due to language evolving due to changes in technology (e.g. the internet-related meaning of *"troll"*), or taking up a new subject or activity (e.g. the sailing term *"boom"*) (Rodd et al., 2012). Learning new word meanings generally takes place incidentally by inferring the new meaning from context (Batterink & Neville, 2011), rather than through intentional memorisation. These studies use a newly developed web-based story-reading paradigm to examine adults' incidental acquisition and long-term retention of novel, artificial meanings for known words (e.g. learning that a *"foam"* means a *"safe concealed within a piece of furniture"*). Engaging stories were written by skilled authors specifically for the studies, giving controlled exposure to the new meanings in a naturalistic context.

Experiment 1 (*N*=40) compared incidental learning of novel word meanings in the story-reading condition to an intentional definition-learning task. Memory for these meanings was tested immediately and after a 24-hour delay using cued recall (e.g. *"what was the new meaning of foam?"*) and meaning recognition (8-alternative forced choice meaning-to-word matching; 8AFC). Both measures showed that new meanings learned intentionally were remembered significantly better than those learned incidentally, although there was good learning from both methods. Intriguingly, the 8AFC measure showed that meanings learned from story contexts were less susceptible to forgetting after 24 hours.

Experiment 2 examined incidental learning performance with varied amounts of exposure. Participants (*N*=64) each read a single story in which they encountered novel meanings for four different words, each encountered 2, 4, 6, or 8 times. Memory for the meanings was tested immediately and a week later. Recall accuracy was reasonably good after only 2 exposures, and increased linearly with increased exposure. Most surprisingly, there was no significant forgetting when participants were re-tested after a one-week delay.

Experiment 3 investigated whether testing participants immediately after training had contributed to the good long-term retention seen after 24 hours (Experiment 1) and one week (Experiment 2), and whether this 'Testing Effect' differs between incidental and intentional learning. Participants (*N*=98) learned new meanings for existing words incidentally and intentionally (as in Experiment 1), and were then tested immediately (without feedback) on half the items (cued recall and recognition). After 24 hours, accuracy was higher for items that had been tested immediately compared with those that had not. Interestingly, this Testing Effect was larger for incidental than intentional learning.

These findings show that adult readers are highly proficient at learning new meanings for familiar words from a small number of encounters within naturalistic story contexts. Importantly, although performance at test was significantly worse than an intentional training condition, retrieval practice immediately after training boosted long-term retention of new meanings in this incidental learning condition. This finding suggests that learning new vocabulary from books in classroom settings could be significantly boosted by including short vocabulary quizzes following reading.

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Statistical Learning as Chunking:
A Novel Memory-Based Measure of Statistical Learning

Erin S. Isbilen, Stewart M. McCauley, Evan Kidd & Morten H. Christiansen

Statistical learning—sensitivity to distributional regularities in the input—is suggested to play an important role in language acquisition and use. However, the question remains as to what the nature is of the neural mechanisms underlying such learning. Here, we explore the hypothesis that statistical learning is supported by chunking, a basic mechanism of learning and memory. To test this hypothesis, we adapted the classic serial recall memory paradigm to test statistical learning through a statistically-induced chunking recall (SICR) task. We reasoned that artificial language exposure would lead participants to chunk recurring statistical patterns into words, which should facilitate recall of the tri-syllabic words from the input. Critically, the experimental items in our task consisted of two concatenated words from the input language (Word A + Word B), and control items consisted of the exact same six syllables in a random configuration. The scoring for SICR is performed syllable-by-syllable, which enables the evaluation of sensitivity to trigrams and serial position, and thereby offers more granular insights into learning than the binary correct-incorrect scoring of the two-alternative forced-choice (2AFC) task often used in statistical learning studies.

In Experiment 1, we compared the efficacy of SICR to 2AFC in capturing statistical learning using the classic Saffran, Newport and Aslin (1996) paradigm. In line with our hypothesis, participants accurately recalled significantly more syllables for the experimental SICR items than the controls ($t(68)=13.85$, $p<.0001$), and also recalled significantly more trigrams within the experimental items ($t(68)=13.72$, $p<.0001$). Furthermore, our results revealed a strong order effect on 2AFC performance. Participants who performed SICR prior to 2AFC scored significantly higher on 2AFC ($t(68)=12.06$, $p<.0001$). Conversely, SICR performance was unaffected by order, which suggests that this task may be a more stable measure than 2AFC. In Experiment 2, we established the test-retest reliability of SICR. In addition to replicating the recall results of Experiment 1, we found that SICR demonstrates higher test-retest reliability ($r(24)=.81$, $p<.0001$) than that reported for 2AFC by Siegelman & Frost (2015; $r=.63$). This indicates that SICR may be a more stable measure of learning both within and between individuals. Additionally, preliminary results from an on-going Experiment 3 that uses SICR to measure statistical learning in 5-6-year-old children (N=51) demonstrates that recall of the experimental SICR items significantly correlated with children's language comprehension ($r=.45$, $p=.001$). Conversely, 2AFC performance demonstrated no significant correlation with language abilities ($r=.19$, $p=.198$).

The results from Experiment 1 and 2 show that our novel SICR task offers a stable and sensitive measure of individual differences in statistical learning. When taken together with Experiment 3, our findings provide preliminary support for the hypothesis that basic chunking mechanisms not only play an important role in statistical learning but also may be crucial for language acquisition and processing (Christiansen & Chater, 2016).

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Tug of war between top-down and bottom-up processing in bi-alphabetism

Mina Jevtović, Laboratory for Neurocognition and Applied Cognition, University of Belgrade, mina.jevtovic@yahoo.com
Vanja Ković, Laboratory for Neurocognition and Applied Cognition, University of Belgrade, vanja.kovic@f.bg.ac.rs
Guillaume Thierry, School of Psychology, Bangor University, g.thierry@bangor.ac.uk

Most models of the visual word recognition propose interactive activation that includes both top-down and bottom-up processes (McClelland and Rumelhart, 1981; Coltheart et al., 2001). The existence of two orthographically different, but partially overlapping scripts with the same phonology, allows us to directly compare the influence of bottom up and top down activation. This characteristic of the Serbian language, know as bi-alphabetism, provides a unique opportunity for testing the models of visual word recognition within one language.

In a simple lexical decision task, we presented our participants with four groups of words (400 altogether) created using only unique letters, which are alphabet specific and therefore cannot appear in the other script, and common letters (A,O,E,M,T,J,K) which are shared between two scripts. Words from the first group or *Real words*, were created using letters from one script only "ČEŠALJ" (/comb/). Second group was a *Mixed words* group were we replaced one letter with its pair from the other alphabet "**Ч**EŠALJ" (/comb/). The same logic was applied for creating real and mixed non-words, where *Real non-words* had all the letters from one alphabet "ĐEŠALJ", while *Mixed non-words* included one letter from the other "**Ђ**EŠALJ". All of the words were the same length (5 letters) and were highly familiar and typical. Our participants were instructed to focus on the meaning of the word and decide whether the string of letters presented on the screen is a word or a non-word. This way, the emphasis was put on top-down activation.

Reaction times were analyzed using linear mixed-effects models (Baayen, Davidson and Bates, 2008) with *subjects* and *words* as random-effects factors and *group* as a fixed effect factor. The analysis showed that Real words elicited shorter reaction times than Mixed words ($\beta = 0.11$, $SE = 0.01$, $z = 9.32$, $p < .001$). Real words were also faster than Real non-words ($\beta = 0.22$, $SE = 0.01$, $z = 20.05$, $p < .001$). Significant difference was observed between Mixed words and Mixed non-words ($\beta = 0.15$, $SE = 0.01$, $z = 9.72$, $p < .001$). However, no significant difference emerged between Real and Mixed non-words ($\beta = -0.02$, $SE = 0.01$, $z = -1.38$, $p > .05$). In the model with Accuracy as the dependent variable, a Logistic LMMs for binomial distribution was used (Jaeger, 2008). The analysis showed that participants made more errors on Mixed words ($\beta = -1.19$, $SE = 0.16$, $z = -7.27$, $p < .001$) compared to Real words. Different pattern of results was present between Real and Mixed non-words, where participants made more errors on the Real non-word trials ($\beta = 0.54$, $SE = 0.16$, $z = 3.43$, $p < .05$).

The results indicate that orthography plays an important role in accessing the meaning of the word in Serbian. Even though both scripts are used equally and have the same phonology, interference between them has an inhibitory effect on top-down processes, as observed through direct comparison between real words and mixed words, as well as real non-words and mixed non-words. Future studies will focus on the investigation of this effect in the opposite direction.

Online processing of case in Korean in native speakers and adult learners

Cheryl Frenck-Mestre[1,2] SeungKyung Kim[1], Hyeree Choo[3], Alain Ghio[1,2] & Sungryong Koh[3]

1. Centre National de Recherche Scientifique, 2. Aix-Marseille Université, 3. Seoul National University

How quickly do native speakers use case marking to interpret sentence meaning and when, if ever, do non-native speakers do such? Eye movement data suggest that native speakers immediately use case to compute sentence structure (Koh, 1997) and to anticipate upcoming arguments (Kamide et al., 2003). There is some evidence that adult learners of Korean whose L1 lacks case marking on full NPs are at a disadvantage compared to those whose L1 does (Brown & Iwasaki, 2013). Indeed, despite its universal nature, correctly interpreting and producing case is a source of difficulty for L2 learners (Ahn & Herschensohn, 2013; Hopp, 2010). Herein, we examined how both native Koreans and adult L1 French learners of Korean process case particles in spoken Korean sentences.via the recording of eye movements.

We manipulated both case and word order in auditory sentences in a 2 x 2 design. Experimental sentences were presented either in canonical SOV or scrambled OSV order and contained either a nominative and accusative or a nominative and dative case marked noun. Twenty noun pairs (doctor/nurse; teacher/student, etc) and 10 verbs (5 transitive, 5 dative) were used and all sentences were presented in both orders across counter-balanced lists. Participants saw 2 scenes (1 on each side of the screen) for 1 second prior to sentence onset and chose which of the 2 matched the auditory sentence. Eye movements were time locked to the onset of critical elements: N1, N2 and the verb. Participants were 16 native Korean speakers (KN) and 16 native French speakers residing in Korea who had studied Korean formally for at least 400 hours. Generalized linear mixed effect models were used to test whether participants looked at the correct image above chance level, at each critical element. The complete model showed an interaction between Group and Element ($z = 6.78$, $p<.0001$). At N1, both KN and L2 learners showed chance level looking at the correct image. At N2, L2 learners continued to show chance level looking but KN showed a trend to look at the correct image above chance ($z= 1.42$, $p<.15$) independent of Case or Order. At the verb, KN looked at the correct image nearly 80% ($z=6.11$, $p<.0001$) independent of Case or Order; for L2 learners, there was an effect of Order ($z = 4.07$, $p<. 001$) but not of Case ($z = 1.32$, n.s.) nor any interaction ($z<1$). L2 learners looked at the correct image significantly higher than chance only for canonical word order, independent of case. Concerning response accuracy, KN had ceiling level performance independent of Order or Case. For L2 learners, glmer analyses revealed an effect of Order ($z = 7.95$, $p<.0001$) that was modified by Case ($z = 3.19$, $p<.001$). For SOV order, accuracy did not differ as a function of Case (87% and 85%); for OSV order, accuracy was significantly lower for accusative (33%) than dative (54%) sentences.

Overall, our results reveal that listeners did not rule out the incorrect image until they heard the verb. KN committed entirely at this point and had ceiling level accuracy. The pattern for KN may be due to the inherent ambiguities in dative structures and/or to the necessity to program and execute a saccade to the correct image during the N2. For L2 learners, our results suggest that case marking is not computed online. Both accuracy and the pattern of eye movements revealed that word order superseded case in the actual auditory presentation, leading to misinterpretation for scrambled sentences. This effect was nonetheless attenuated for dative sentences as concerns accuracy rate.

The effect of deep brain stimulation on statistical grammar learning in Parkinson's Disease

Ferenc Kemény[1], Gyula Demeter[2,3], Mihály Racsmány[2,3], István Valálik[4] & Ágnes Lukács[2]

(1) Institute for Psychology, University of Graz, Graz, Austria
(2) Department of Cognitive Science, Budapest University of Technology and Economics
(3) Frontostriatal System Research Group, Hungarian Academy of Sciences
(4) Department of Neurosurgery, St. John's Hospital, Budapest

Although the improvement of motor symptoms in Parkinson's disease (PD) after deep brain stimulation (DBS) of the subthalamic nucleus (STN) is well documented, there are open questions regarding its impact on cognitive functions. We aimed to assess the effect of bilateral DBS of the STN on learning an artificial grammar. Twelve PD patients with DBS implantation (DBS group) and twelve PD wait-listed patients (control group) participated in the study. During training, participants were acoustically exposed to 58 sentences generated by a phrase structure grammar. In the test phase participants had to decide for 24 pairs of novel grammatical and ungrammatical sentences which one was more similar to the language heard before. The task was administered twice: before and after surgery (with the stimulators on) in the DBS group and with a similar time interval between the two task-administration points in the control group. Performance of the DBS group increased from T1 to T2, while learning performance of the wait-listed group did not show a significant change. Methodological concerns warrant further studies, but these results suggest that DBS may have a beneficial effect outside the motor domain, on cognitive functions that rely on pathways related to the STN.

Working Memory, Language Experience and L2 Comprehension Ability

Elma Kerz (RWTH Aachen University)
Daniel Wiechmann (University of Amsterdam)

Considerable variability has been observed in both the native [L1] and non-native [L2] sentence processing literature (see, [1] for a review in L1 context; see, [2] for a review in L2 context). In the L1 literature, it has long been established that language comprehension ability is strongly associated with individual differences (IDs) in working memory (WM) capacity (cf., e.g., [3] [4] [5]). However, in the L2 literature only few studies have investigated the effects of IDs in WM capacity on sentence processing with mixed results [6] [2]. Furthermore, there is a growing recognition that the relationship between WM and L1 comprehension ability is affected by linguistic experience ([7] [8]; see [9] for an overview). A recent study has provided first direct experimental evidence that verbal WM scores are predictive of L1 processing ability and significantly correlated with measures of the amount of language experience [10].

Building upon the insights gained from the L1 literature, the goal of the present study is twofold: (1) to determine whether and to what extent verbal WM capacity as gauged by reading span task correlates with IDs in two "proxy measures" of L2 experience assessed via an L2 vocabulary task (LexTALE, cf. [11]) and the number of months spent abroad in an English-speaking country and (2) to investigate the relationship between vWM scores and performance in an L2 comprehension task. Thirty-four German advanced L2 learners of English participated in this study. Verbal WM capacity was assessed using a modified version of the Waters and Caplan (1996) reading span task [12]. Performance on this task was scored using a composite score by summing up the standardized scores for the speed, (semantic judgment) accuracy and recall components of the task. To assess L2 comprehension ability, we decided to use the sentence comprehension task presented in [13]. This task was based on sentence material drawn from three different prior studies capturing various aspects of language processing. Following [13], the measures of interest for our analyses were the comprehension accuracy scores.

We found significant positive correlations between the verbal WM scores and both L2 experience measures (WM-L2 vocabulary knowledge: $r=0.38$, $p=0.026$; WM-stay abroad: $r=0.40$, $p=0.016$) (Goal 1). No correlation was found between the two experience measures ($r=0.14$, $p=0.43$). To determine the effects of IDs in vWM capacity on L2 comprehension ability (Goal 2), a mixed logit model was fitted to the comprehension accuracy scores. We found that WM capacity exerted a significant effect on the performance in the L2 comprehension task ($\beta=0.18$, $SE=0.07$, $z=2.67$, $p=0.08$): individuals with higher vWM scores exhibited better comprehension performance. No independent effects of two experience measures were observed.

Taken together, our findings provide (1) additional evidence in support of the involvement of WM in L2 sentence processing and (2) first evidence that WM capacity is affected by L2 experience. These results suggest that, as recently pointed out in [10], accounts of IDs in both L1 and L2 sentence processing can benefit from an integration of experiential factors.

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Mutual interactions between epistemic prosody and co-speech gestures

Evangelia Kiagia[1], *Joan Borràs-Comes* [2,1], *Pilar Prieto*[1]
[1] Departament de Traducció i Ciències del Llenguatge, Universitat Pompeu Fabra, Barcelona
[2] Universitat Autònoma de Barcelona (UAB), Barcelona, Spain,
evangeliamaria.kiagia@upf.edu, joan.borras@upf.edu, pilar.prieto@upf.edu

During daily face-to-face communication, we constantly make use of audiovisual information that helps us process information and communicate meanings effectively. Gesture has been shown to be integrated with speech both from a temporal and from a semantic point of view (McNeill 1992). Recent studies have found an obligatory and mutual interaction between speech and iconic gestures during semantic processing, which has led to the integrated-systems hypothesis (Kelly et al. 2009; Kita & Özyürek 2003). However, little is known about the potential interaction between co-speech gestures and prosody, in other levels other than the semantic one. Additionally, intonation contours, as well as certain types of co-speech gestures, have been shown to encode epistemic information (such as degrees of speaker knowledge; Borràs-Comes & Prieto 2015). Moreover, specific gestures and intonational patterns have been associated with epistemic meanings such as the speaker's commitment to the proposition expressed (Dijkstra et al. 2006; Borràs-Comes & Prieto 2011; Crespo-Sendra et al. 2013; Roseano et al. 2016).

Two experiments were conducted to examine whether the presentation of silent epistemic gestures prompts the production of the corresponding epistemic (certainty-uncertainty) intonation contours (Exp. 1), and whether in an eye-tracking paradigm presenting epistemic intonations determines the selection of target gestures (Exp. 2). We initially run a discourse completion task (DCT) to create a corpus of epistemic prosody-gesture matching pairs, which resulted in 4 epistemic conditions, i.e., 2 levels of *commitment/certainty* on two levels (*high commitment* or *certain, low commitment* or *uncertain*) in 2 different sentence modalities *(statements, questions).*

In Experiment 1, 20 native speakers of Catalan were first presented with visual primes of silent videos containing gestures depicting the 4 abovementioned epistemic conditions (used 20 single-word items). After each silent video, they were asked to reproduce the target words with the intonation they thought that matched the gestures. A GLMM was run with Contour as the dependent variable (2 levels: 0 for falling tunes, i.e., both H* L% and L* L%, and 1 for rising tunes, i.e., L* H%). The fixed factors were Modality (st, qu), Level (hi, lo), and their interaction. All effects were found to be significant. More rising tunes were found for questions ($F = 6.147$, $p = .014$) and low commitment conditions ($F = 75.597$, $p < .001$). The interaction ($F = 16.473$, $p < .001$) suggests more rising tunes were used for questions than for statements when high commitment is analyzed ($p = .011$), thought this difference was not found when low commitment is analyzed ($p = .429$).

In Experiment 2, 30 native speakers of Catalan participated in an eye-tracking task. They were first presented with a black screen while playing an auditory stimulus produced with one of the 4 epistemic intonations obtained in the DCT (for 20 single-word items). That black screen was followed by a screen containing two slowly-played silent videos (target & competitor) reproduced simultaneously side by side (with their position counterbalanced). The participants had to choose which gesture was related to the prosody they just heard. Their eye-movements and their keyboard responses were recorded. Two GLMMs were run, one with the number of fixations and another one with gaze duration as their dependent variables (plus an additional GLMM for their keyboard responses). Modality (st, qu), Level (hi, lo), AOI (targ, comp) and all their possible interactions were set as fixed factors. The main effect of AOI was found to be significant in the two eye-data GLMMs, indicating that more fixations and gaze-time were associated to targets compared to competitors. Other significant effects suggest that statements were easier to process than questions.

All in all, Experiments 1 and 2 show a mutual, bidirectional influence between the two systems. Therefore, this study sets the background for an integrated systems hypothesis between gestures and prosody on the pragmatic level.

Bilingual Processing of Flexible Constituent Order in Korean

Dayoung Kim (UC San Diego), Gyeongnam Kim (Sogang University), Savithry Namboodiripad (University of Michigan)

Constituent order systems have been shown to reduce in flexibility due to language contact (Heine 2008). However, a causal link between contact and reduced flexibility has not yet been established experimentally, and there is still much to be explored as to how bilingual speakers use their knowledge of one language in their processing of another. Using an acceptability judgment experiment as a global measure of processing difficulty, we compare native Korean-speakers with English-dominant Korean-speakers (heritage speakers), finding that contact is associated with reduced flexibility (defined as lowered acceptability for non-canonical orders relative to canonical order) in constituent order.

Korean canonical order is SOV; post-verbal arguments are possible in some contexts, with no restriction on the number of post-verbal elements (Ahn 1988, Yun 2014). Grammatical non-canonical orders lead to lowered acceptability (e.g., Weskott & Fanselow 2011), so SOV should be most acceptable followed by OSV, verb-medial orders, and, finally, verb-initial orders. Thus, we consider two hypotheses about how experience with a canonical SVO language, English, should affect acceptability of Korean constituent order. H1: If English order affects Korean, Korean SVO should be more acceptable for English-dominant participants than for Korean-dominant speakers. H2: Because heritage speakers show lowered acceptability for difficult constructions (e.g., Scontras et al. 2015), all non-canonical orders should be less acceptable for English-dominant participants: lower flexibility.

30 Korean-dominant and 27 English-dominant participants (data collection is ongoing) rated sentences with animate subjects, inanimate objects, and transitive verbs, plus fillers (presented auditorily). Results show a 4-way distinction in acceptability for both groups: SOV>OSV>{SVO,OVS}>{VSO,VOS}. Non-canonical orders are significantly less acceptable for English-dominant participants than Korean-dominant participants, including SVO (contra H1). Splitting the English-dominant participants based on Korean proficiency, passive bilinguals consistently rate non-canonical orders lower than active bilinguals. Our results align with H2: English-dominant participants differ from Korean-dominant participants in degree not kind, showing lower acceptability for non-canonical orders, presumably due to associated increases in processing difficulty for these more complex constructions. Following our operational definition of flexibility, increased contact with English corresponds to decreased flexibility in Korean. This leads us to expect increased reliance on canonical order as opposed to borrowing of constituent order in other contexts of societal bilingualism where dominance is shifting from flexible to fixed languages.

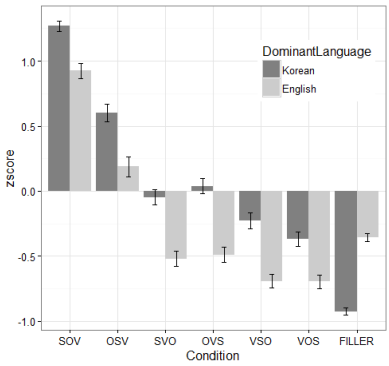


Fig 1. Korean-dominant vs. English-dominant

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Effects of syntactic dependency length on on-line text processing and comprehension

Suzanne Kleijn, Henk Pander Maat & Ted Sanders – Utrecht University

Syntactic dependency length (SDL) is a measure of the distance between a syntactic head and its dependent (e.g., verb-subject). Long dependencies are believed to require more computational resources and take more effort to understand than short dependencies. This is reflected in the 'locality effect': a localized increase in reading time at the point of the dependency resolution (Bartek et al., 2011; Gibson, 2000). However, in SOV languages it is possible to have an 'anti-locality effect' as well (Konieczny, 2000; Levy & Keller, 2013). This is a decrease in reading time caused by the intervening materials guiding readers' expectation for the upcoming head.

Studies on SDL have only focus on a limited number of syntactic structures - mostly involving relative clauses. In addition, they always presented sentences in isolation. As a result, little is known about how SDL influences other types of sentences and what happens when these sentences are presented in context. In two experiments we investigated how syntactic dependency length influences the way readers process and understand normal texts. In Experiment 1, eye-movement data of 181 Dutch 9th-grade students was collected while they read 4 Dutch texts. Two text versions were produced by changing the word order in 1/3rd of the sentences (see 1a-b). This resulted in a version with longer SDL sentences and a version with shorter SDL sentences. All manipulations were dictated by the possibilities offered by the materials. As a result, the length with which the SDL was increased or decreased ranged from 2 to 10 words. Multilevel analyses of the sentence reading times showed that reading times were longer when the SDL was increased. This effect was independent from the size with which the SDL was increased.

(1) a. *De aangehoudene* *dient* *onverwijld* *overgedragen* *te worden* *aan een opsporingsambtenaar (politie).*
The detainee needs immediately handed over to be to a criminal investigator (police).

b. *De aangehoudene* *dient* *onverwijld* *aan een opsporingsambtenaar (politie)* *overgedragen* *te worden.*
The detainee needs immediately to a criminal investigator (police) handed over to be.
'The detainee needs to be handed over to a criminal investigator (police) immediately.'

In Experiment 2, an additional 16 texts were manipulated. The 20 texts were transformed into HyTeC-cloze tests (Kleijn et al., 2017) to measure text comprehension. 824 students (grades 8-10) filled out 4 cloze tests. Increasing the SDL resulted in lower scores. However, this effect could not be generalised over all texts, except when the difference in SDL was higher than 5. Overall, the results of these experiments suggest that long SDLs have a negative effect on readers' performances and are better avoided.

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Does self-production affect changes in referential forms during dialogue?

Dominique Knutsen (University of Essex, UK)
Amélie M. Achim (Université Laval, Québec, Canada)
Arik Lévy and Marion Fossard (Université de Neuchâtel, Switzerland)

Introduction

When a speaker mentions a referent repeatedly during a dialogue, the referential form used (pronoun, noun phrase) may be adjusted throughout the interaction: noun phrases are used when a referent is introduced for the first time, and pronouns are used when the same referent is mentioned again (Achim, Achim, & Fossard, 2017). As the interaction unfolds, a referent may be mentioned for the first time by one person and then mentioned again by another person: would the second person also switch to using pronouns? Previous research on self-production effects in dialogue may shed light on this question. Self-production refers to self-produced information being more readily accessible in memory than information produced by one's dialogue partner (Knutsen & Le Bigot, 2014). This could modulate the effect of the referent's cognitive status on changes in referential forms. When a referent is mentioned for the second time, the speaker may be more likely to switch to using a pronoun when she produced the initial reference herself than when the initial reference was produced by the other person, because self-production would have made the reference more accessible in her memory in the former case. The purpose of this study is to test this hypothesis.

Method

25 pairs of native English speakers took part in a variation of the Matching Game, in which a Director told a story to a Matcher to enable the latter to reorder correctly the six pictures making up the story. In control trials, the participants' roles remained the same throughout. In alternating trials, the participants switched roles after each picture. Thus, the participant who described the first picture introduced the character(s) of the story; both participants then had the opportunity to mention them again in the remainder of the trial. We examined the referential forms used throughout the trial to determine:

(1) whether the participants used different referential forms (e.g., noun phrase then pronoun) as they referred repeatedly to the characters of the story;

(2) whether different patterns of referential changes were observed when the first mention of the reference had been performed by oneself or the other participant.

The number of characters (one or two) and their gender (same or different) were also manipulated to examine how the features of the story affect reference production as well.

Results and discussion

The data have been collected and the full analysis will be presented at the conference. In control trials, participants should switch to using pronouns when referring to a referent more than once. This should also happen in alternating trials, but mainly when the initial reference was self-produced. These results will contribute to a better understanding of how the collective nature of dialogue affects referential choices as the interaction unfolds.

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Do Prosody and Case Marking Influence Thematic Role Assignment in Ambiguous Action Scenes?

Julia Marina Kroeger[1], Katja Muenster[2], Pia Knoeferle[2]
[1]Bielefeld University, Germany; [2]Humboldt University Berlin, Germany

In language processing, adults rapidly recruit case marking (Matzke et al., 2002), prosody (Weber et al., 2006) and non-linguistic information (Chambers et al., 2004; Sedivy et al., 1999; Tanenhaus et al., 1995) to assign thematic roles. For children, by contrast, effects of prosody and case marking emerged in some (Grünloh et al., 2011; Özge et al., 2016) but not all (Dittmar et al., 2008) studies.

Using eye tracking, we investigated whether five-year old children (Exp 1a) and adults (Exps 1b, 2a, 2b) can rapidly recruit prosody and/or case marking for thematic role assignment in ambiguous action scenes. Visual scenes contained three clipart animal characters each. Two characters performed identical actions. Thus, the scenes provided a context but did not disambiguate the role relations. We manipulated sentence structure and prosody. Case unambiguously marked German subject-verb-object (SVO) and object-verb-subject (OVS) sentences in Exps 1a, 1b, 2a; Exp 2b manipulated ambiguity within OVS (unamb. vs. amb.). We emulated the SVO and OVS biasing prosody by Weber et al. (2006) - SVO: L*+H accent on the subject, H* accent on the verb; OVS: L+H* accent on the subject - and added a neutral prosodic contour as a baseline (Exps 1a and 1b). In Experiments 2a and 2b, sentences each had either an SVO biasing or an OVS biasing prosodic contour.

Results revealed no clear effects of prosody on thematic role assignment in either children, or adults. Adults rapidly exploited case marking to predict role relations, as early as the verb. However, when case marking was ambiguous, adults initially interpreted OVS sentences as agent-first sentences (i.e. as SVO). Children did not exploit case marking for thematic role assignment but mistakenly interpreted OVS as agent-first (SVO) sentences. One explanation for the absence of clear effects of prosody in adults might be that case marking is a stronger cue for thematic role assignment than prosody. In terms of case marking effects in children, previous studies provided additional world knowledge information that could help with role-relation disambiguation (e.g. Özge et al., 2016). In our study, we did not provide such information. Children at the age of five might need additional information in order to use case marking for thematic role assignment.

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Lexical difficulty and looking at nothing: Less imageable and abstract words lead to more looks to blank locations

Alper Kumcu, Robin L. Thompson
University of Birmingham, School of Psychology

People look at previous (but now empty) locations of visually presented single words when they are retrieving them from memory (Kumcu & Thompson, 2016). When encoding visually presented linguistic information (i.e., printed words), our integrative memory system attaches spatial information (encoded as spatial indices) to spatial locations where information appears. These locations can then be visually revisited during retrieval. When the linguistic information is absent during retrieval, spatial indices trigger eye movements to the blank location of the previously presented information (Richardson & Spivey, 2000). This behaviour, known as *looking at nothing*, changes with memory load and the strength of mental representations. For example, people look less at 'nothing' when the retrieval task becomes easier through repetition (Scholz, Mehlhorn, & Krems, 2011).

We investigated whether words that are more difficult to remember lead to more looks to blank locations. Participants were presented four nouns on a two by two grid and auditorily probed in an old/new recognition memory task for one of the four nouns. Half the word sets were composed of low difficulty words, half high difficulty (i.e., less imageable, more abstract, less available, less pronounceable, learnt later in life, longer and had less phonological and orthographic similarity with other words in the lexicon). Results revealed more frequent looks at blank locations during retrieval of high difficulty nouns compared to low difficulty ones. Mixed-effect modelling revealed that imagery-related semantic factors (imageability & concreteness) predict looking at nothing during retrieval. Retrieval performance is also predicted by phonological and orthographic factors (phonological similarity, orthographic similarity, length in letters & syllable length). Additionally, individual differences emerged such that participants with better imagery control (based on self-reports) looked more at blank locations.

Overall, the results provide the first evidence that looking at nothing is modulated by the specific language information to be retrieved. Findings provide substantial support to the integrated memory account for linguistic stimuli. Words that are more difficult to remember require more looks to blank locations for successful retrieval as their mental representations are weaker than low difficulty words and thus, impose higher load on memory during retrieval. Word imageability and concreteness were found to be the strongest variables for looking at nothing, highlighting the critical link between memory for language, imageability and eye movements. Accordingly, looking at nothing for language can be regarded as a type of mental imagery.

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The role of cognitive control in garden path resolution and word production

Enikő Ladányi[1,2], Kornél Németh[2], Ágnes Lukács[2]
1. Université Paris Descartes, Laboratoire Psychologie de la Perception
2. Budapest University of Technology and Economics, Department of Cognitive Science

Recent proposals (eg. Novick et al., 2010) claim that domain general cognitive control abilities (CC) responsible for the resolution of conflict or interference between competing representations might be recruited during language production and comprehension. We aimed to examine whether individual differences in different measures of CC are associated with performance on language tasks involving competing representations: in the comprehension of garden path sentences and in word retrieval under high interference.

We measured individual differences in 54 Hungarian speaking adults in the size of garden path effects, in naming speed of pictures under high interference and in two n-back tasks measuring general CC. The garden path effect was measured in a self-paced reading task. Participants read sentences with verbs which have both transitive and intransitive uses (eg.: *play*). In each sentence a noun phrase appeared after the verb supporting the transitive analysis but in garden path sentences it turned out to be the object (subject in English) of a subordinate clause (*Míg a zenekar játszott egy szimfóniát mutattak be az iskolában* 'While the orchestra played a symphony was presented in the school'), while in control sentences, the noun phrase following the verb was in fact the object of the main verb (*Míg a zenekar játszott egy nyitányt egy szimfóniát mutattak be az iskolában* 'While the orchestra played an overture a symphony was presented in the school'). In the picture naming task several pictures were presented at once on the screen and the task was to name them as quickly as possible. In the low conflict condition pictures were selected from different semantic categories (chair, apple, dog, etc.), in the high conflict condition pictures were selected from the same semantic category (apple, banana, strawberry, etc). During sentence comprehension CC might be invoked for the resolution of conflict between the initially dominant and the correct analysis while during picture naming, it may help selecting among the multiple semantically similar competing word representations. To examine whether general CC abilities are invoked during the resolution of linguistic conflict, we also tested CC abilities in a verbal (letters) and a nonverbal (fractals) 2-back task.

Participants showed a garden path effect and they also took longer to name pictures in the high conflict condition than in the low conflict condition. No correlations were observed between individual differences in RT increases for the conflict condition in the language tasks and with either verbal or nonverbal n-back scores, suggesting domain general processes of cognitive control are not recruited during these language task, and arguing for conflict resolution processes specific to language.

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Context-dependent idiom processing in elderly adults: An ERP study

Amélie la Roi, Simone Sprenger, & Petra Hendriks
Center for Language and Cognition Groningen, University of Groningen

Background In societies with ever increasing life expectancies, age-related cognitive decline is an important phenomenon whose properties and dynamics are still only poorly understood. An important aspect of this process seems to be the decline of executive functions (e.g. Salthouse, Atkinson, & Berish, 2003): a set of general cognitive control processes, such as shifting between tasks, updating and monitoring of working memory representations, and inhibiting dominant responses (Miyake et al., 2000). They have also been shown to be involved in language. For example in language processing and comprehension, important roles have been assigned to working memory (e.g., Daneman & Carpenter, 1980) and inhibitory skills (e.g., Gunter, Wagner, & Friederici, 2003). So far, the link between general executive functions and language has only been established for healthy adults. Therefore, an interesting question is how age-related decline in executive functions affects language processing abilities.

Method To examine this question, 25 younger adults (age 18-28) and 25 elderly adults (age 61-74) read literal and idiomatic expressions preceded by a neutral or predictive context sentence. We recorded participants' event-related potentials (ERPs) while they processed the sentence pairs.

Results Investigation of participants' ERPs revealed that both groups showed the same decrease in N400 amplitude for the processing of idiomatic compared to literal sentences, indicating that younger as well as elderly adults benefitted from the idioms' predictability. Moreover, younger, as well as elderly adults showed a decreased N400 for test sentences preceded by a predictive context. This demonstrates that both groups were able to benefit from context information to facilitate the retrieval of literal and idiomatic expressions. However, only elderly adults showed an increased P600 for literal, but not idiomatic sentences preceded by a predictive context sentence, showing that elderly adults depended on context information when integrating words in literal sentences.

Conclusions Our results demonstrate that when it comes to the retrieval of lexical information in literal, as well as ambiguous expressions such as idioms, elderly adults' language processing remains largely intact. However, when the meaning of multiple words needs to be integrated in a sentence word by word, processing load may exceed elderly adults' cognitive capacities. Consequently, context information may become particularly important for them to construct a sentence level representation. In general, we take our study as supporting the view that age-related decline in executive functions affects elderly adults' language abilities in such a way that they rely more heavily on context information.

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Processing schematic quadra-syllabic idiomatic expressions in Chinese: structural and semantic compositionality

Daniel T. Lee & Hintat Cheung
The Education University of Hong Kong

Idiomatic expressions and idiomaticity are universal in languages (Katz & Postal, 1963). They are usually a closed class of fixed lexical unit but are not completely homogeneous. The figurative nature and compositionality of these expressions raise some processing and learning difficulty to learners and native speakers as well (Nippold & Duthie, 2003). Chinese language, like some Asian languages, has many frequently-used quadra-syllabic idiomatic expressions (QIEs). However, research on schematic quadra-syllabic idiomatic expressions (S-QIEs) is somehow missing. S-QIEs are semi-fixed and productive and they can be structurally decomposed to a number of constructions, e.g., XAXB schema, where A and B can form a compound. This unique schematic QIE raises interesting issues in grammar, language processing and acquisition.

This study, as part of a series of study, investigates from a processing perspective the missing piece in grammar. We investigated the compositionality/analyzability of S-QIEs to see whether and how structural and semantic components facilitate or affect the way people comprehend the unit, and to see potential interactions between these components. Specifically, structural schemas, semantic opacity and natures of the AB compound were examined. Eye-tracking method was used with native Mandarin Chinese. Participants read QIEs and made lexical decisions. Eye movement measures and decision accuracy were recorded.

Results show that the structural frame of S-QIEs helps processing during reading comprehension, and different semantic configurations affect processing behaviours. Discussions cover the structural nature of different constituents of S-QIEs, rationales of its compositionality and productivity nature, as well as reading and processing models (e.g., Glucksberg, 2001; Nippold & Duthie, 2003). And, S-QIE is advocated to be included in a formal grammar system (e.g., Fillmore, Kay, & O'Connor, 1988; Goldberg, 2006), which is beneficial to the L1 and L2 teaching and learning of this culturally and linguistically important category.

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Would you like to come up and see my etchings? Sensitivity to contextual cues in the comprehension of indirect meaning.

Elizabeth Le-luan[1], Jeffrey Wood[1], Bo Yao[1], Matthew Haigh[2], Andrew J. Stewart[1]
([1]University of Manchester, [2]Northumbria University)

Many aspects of language use involve the communication of meaning indirectly (Pinker, Novak, & Lee, 2008). For example, someone might enquire about a friend's experience on an undergraduate course by asking *"How are you doing in Chemistry?"* If the friend answered with an excuse, such as "*The exams are not fair*", that did not directly answer the question their response would likely be interpreted negatively (i.e., that they were not doing well on the course). The fact that the question was not answered directly by the addressee is an important cue that a negative meaning is likely being communicated. In addition to replies, requests can also be framed indirectly. For example, in the context of a speeding motorist being stopped by a traffic cop, the motorist uttering "Perhaps there is another way we can resolve this" is likely to be interpreted as offering a bribe. Indirect requests allow for plausible deniability and tend to be produced when the degree of imposition of the request on the receiver is high (Lee & Pinker, 2010).

In two eye-tracking experiments we examined how readers comprehend indirect requests (Experiment 1) and replies (Experiment 2). Participants read vignettes that described two characters engaged in dialogue. In Experiment 1 (N=60, 28 vignettes), we manipulated whether context described a situation in which the level of imposition on the receiver of the request was high (thus motivating the use of indirect language) with one in which the level of imposition was low (thus not motivating the use of indirect language). We compared the comprehension of requests phrased indirectly with the comprehension of requests phrased more directly. Linear mixed model analysis revealed that requests phrased indirectly were read more quickly in contexts where the level of imposition on the receiver was high versus where the level of imposition was low. This effect emerged on total reading times for the critical region. In contrast, we found that the processing of requests phrased more directly did not vary as a function of level of imposition.

In Experiment 2 (N=24, 24 vignettes), we examined how readers comprehended indirect replies when uttered in reply to a direct question. Each dialogue contained a direct question answered with an indirect reply. In response to direct questions, such indirect replies are typically used to avoid a face-threatening disclosure. Of the three contexts we examined, the first described a negative, face-threatening situation, the second a positive, non-face threatening situation, while the third was neutral. Linear mixed model analysis of reading times to the replies revealed that readers were sensitive online to the face-saving function of indirect replies. We found effects on first pass reading times consistent with the view that readers searched for a potential negative meaning associated with the use of an indirect reply; such replies were processed with ease when context provided a possible negative meaning. In contrast, we observed increased reading times and increased regressions when context did not provide a possible negative meaning.

In conclusion, our eye-tracking data provide evidence that readers are able to use pragmatic cues to quickly identify appropriate meanings of indirect requests and replies.

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Effects of Prosodic and Syntactic Segmentation on Discourse Processing and Speech Production

Mélissa Lesseur[1], George Christodoulides[2], Anne Catherine Simon[2]
[1]IPSY, [2]Centre Valibel, Université catholique de Louvain, Belgium
melissa.lesseur@student.uclouvain.be, george.christodoulides@uclouvain.be, anne-catherine.simon@uclouvain.be

The objective of the present study is to experimentally investigate the cognitive processes of spoken language comprehension and production, and more specifically the effects of different configurations of prosodic and syntactic structure in a task involving memorisation and restitution of procedural discourse. Our experiment has been inspired by the Free Distortion Task (Albertini et al., 2013) in which participants listened to stimuli controlled for prosodic and syntactic structure and were asked to reformulate. We have adapted this experimental paradigm, shifting from the clause level to the discursive level, by manipulating the prosodic and syntactic segmentation of longer utterances (inspired by the model in Simon & Degand, 2011).

Each participant listened to three tutorials (a recipe, a craft project and a gardening task). The same information content was presented in four conditions: (1) simple syntactic units [SU] with congruent prosody, (2) complex syntactic units with congruent prosody, (3) simple syntactic units grouped within larger prosodic units [PU], and (4) complex syntactic units segmented into smaller prosodic units. The resulting 12 recordings were split into 8-13 utterances (duration: mean = 6.25 s, σ = 1.57 s, min = 2.11 s, max = 9.97 s). Participants listened to one utterance at a time and were asked to repeat it (and potentially reformulate) immediately afterwards, so as to avoid overtaxing their working memory. Their speech production was recorded along with the time elapsed between the end of the stimulus and the onset of speech. A Reading Span test (Desmette et al., 1995) was also administered. Participants listened to all three tutorials and were randomly assigned to a different condition for each tutorial. Recording from 41 participants (2 h) were transcribed, annotated and analysed for prosodic and syntactic structure, and information content.

We hypothesise that the configuration between syntactic and prosodic segmentation in the responses is affected by the cognitive load induced by the memorisation task and the syntactic complexity of the input; therefore, we expect that the number of mismatches between prosodic/syntactic boundaries will be significantly higher in conditions (2) and (4) compared to conditions (1) and (3). We also hypothesise that, as long as the memorisation task remains manageable, the stimuli segmentation configuration primes the response segmentation configuration; therefore we expect that in condition (1), the ratio of realisations of one SU within one PU (congruent prosody) will be higher that the average ratio, and that in condition (3), the ratio of groupings of multiple SUs within one PU (grouping prosody) will be higher than the average ratio, at both individual and group level. With respect to this priming of segmentation, we do not expect significant differences between conditions (1) and (3). Finally, we expect a negative correlation between the quality of the restitution (stimulus information units present in each response), and the number of boundary mismatches and frequency of hesitation-related disfluencies.

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Irony in Visual Context

Saskia Leymann, Center for Cognitive Science, University of Freiburg
Verena Haser, English Department, University of Freiburg
Lars Konieczny, Center for Cognitive Science, University of Freiburg

Can the intended meaning of ironic language be understood directly or is it necessary to first interpret the literal meaning of the uttered phrase before re-interpreting it when it comes into conflict with a surrounding context? Gibbs' direct access view (Gibbs, 1986) postulates that given a strong enough context ironic language can be processed as directly as literal language. In opposition to that Giora's graded salience hypothesis (Giora, 1997) states that the most salient – usually the literal – meaning will always be interpreted first, regardless of context. Research so far has produced mixed results, potentially due to the use of methods with low sensitivity to ongoing processes. It also remains unclear what exactly constitutes a sufficiently strong context for processing irony directly in Gibbs' sense.

To address these issues we conducted a series of visual world studies. The most recent one used short picture stories to provide rich contexts. We also used echoic mention (Sperber & Wilson, 1981) as a factor to strengthen the context (as in Gibbs, 1986). A 2x2 factorial design was implemented with irony vs. literal and echoic mention as within-subject factors. 22 Participants were presented with a series of pictures stories, each a sequence of three short scenes. The first scene introduced the situation with two speakers and a person in the background who could be a target of the literal meaning of the target utterance (false alarm). In the second scene two more people entered the situation (visual distractor and target). The third scene contained the target utterance. The intended meaning of the target utterance would be either ironic or literal (factor irony) and have been spoken or not spoken in the preceding dialogue (factor echoic mention). Utterances were the same in both literal and ironic condition so the only clue to a potential ironic meaning was visual. Participants were instructed to click on the person the target utterance referred to at the end of each trial.

Following the direct access view one would expect participants to be equally fast to look at the correct target in both the literal and the ironic condition when echoic mention is realized. Following the graded salience hypothesis one would expect participants to be slower to identify the correct target in the ironic condition, regardless of context strength. Results were analyzed using Growth Curve Analysis (Mirman, 2014). In accordance with Giora's previous studies participants performed significantly better on the selection task in the literal condition compared to the ironic condition. However, when analyzing only trials in which the correct answer was given we found no sigificant difference in participants' eye movements between ironic and literal conditions. When echoic mention was realized the difference in eye movements disappeared nearly entirely. This indicates that while irony is more difficult to identify, the cognitive processes involved in processing it when it has been identified appear to be the same as when processing literal language, even more so when an ironic utterance is presented in a strong context, as Gibbs (1986) suggests.

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Does encouraging the production of beat gestures enhance L2 pronunciation?

Llanes-Coromina, J.; Prieto, P.

In recent years the need for teaching pronunciation and communication skills in a second language (SL) has gained more attention. Existing pronunciation paradigms are typically based on specific drills that practice with isolated sounds and phrases. Recent research has shown that the rhythmic highlighting of the sound structure of the target language through gestures and prosody can be used for improving pronunciation skills. Gluhareva & Prieto (2016) [1] showed the benefits of producing beat gestures (non-referential hand gestures that associate with prosodically prominent positions in speech) in L2 pronunciation improvement. They performed a brief beat training which consisted on observing rhythmic gestures with learners of L2 English. In the gesture-observe condition, they had to watch training videos with spontaneous answers to discourse prompts which were accompanied by beat gestures. Results showed that the training with beat gestures diminished the accentedness of the participants' speech. Little is known about the benefits of producing beat gestures (non-referential hand gestures that associate with prosodically prominent positions in speech) in L2 pronunciation improvement. However, less is known about the effects of producing beat gestures in L2 pronunciation learning, even though there is evidence that the production of beat (as well as iconic) gestures facilitate the production of words in the first language [2]).

The aim of this study is to test whether encouraging the production of beat gestures in a reading task enhances L2 pronunciation. Participants (Mean age = 14,08; SD =,281) were told that they needed to imagine that they were speaking to someone that wanted to travel and they needed to read the text to this person, as if they were not reading, to give information about the specific given country or city. Participants were distributed into two conditions: gesture encouraged and no-gesture encouraged conditions and they were randomly assigned to one of these two conditions (between-subjects design). In the gesture encouraged condition were asked to read two stories without any gestural instruction and in the following two they were asked to move their hands. Students in the no-gesture encouraged condition (control condition) were asked to read the four texts without any gestural instruction. The pilot results of this experiment with a set of 10 speakers seemed to show that participants improve their pronunciation (specifically their fluency and comprehensibility) when they are asked to produce gestures. When participants do not produce gestures, they seem to have a very flat intonation and their pronunciation seems to be better when they produce gestures while reading. Moreover, these preliminary results also show that when participants are asked to "use their hands" they tend to produce more beat gestures (rhythmic hand/arm movements produced in alignment with prominent prosody). Thus we may think that beat gestures enhance English as a L2 pronunciation.

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Subject island variation across dependency types in Spanish and Italian

Sergio López-Sancio & Itziar Laka (University of the Basque Country (UPV/EHU))
sergio.lopez-sancio@ehu.eus

Whereas subjects (S) are islands in English, it has been claimed that in Italian and Spanish they are not (Rizzi ,1982; Torrego, 1984). Sprouse et al. (2016) found that S islands in Italian vary with the type of dependency: in wh-questions (WH) S are islands, in relative clauses (RC) they are not. The aim of the present study is to experimentally test S islands in Spanish to see whether the same pattern of variation across dependency types is replicated, since no differences are expected between these two languages.

We used a factorial definition of islands crossing gap position (O(bject)/S) and structure (non-island/island) (Sprouse et al., 2016). **Exp. 1** & **2** consisted in two AJTs (7-point Likert scale) testing S islands in RC (n=59) and WH dependencies (n=57) in Spanish. We used transitive sentences and the S/O DPs were always indefinite. We found (1) that the island condition is overall less acceptable than the non-island one, (2) that S gaps are overall more acceptable than O gaps, and (3) that the type of dependency impacts acceptability, such that the island condition ameliorates in RC dependencies (Fig. 1 & Fig. 2). Although no super-additive interaction was found, the unacceptability of the island condition in comparison to the non-island one ($\overline{x}$=2.93 vs. $\overline{x}$=6.02) suggests that both S and O are islands in RC and WH dependencies in Spanish, contrary to Italian in Sprouse et al. (2016). Differences may be due to the fact that gap interpretation was ambiguous in the Italian materials in Sprouse et al. (2016), unlike in ours. **Exp. 3** & **4** was a replica of Exp. 1 & 2 in Italian (n=82 and n=48, respectively). When controlling for gap ambiguity, we found a similar pattern of results as in Exp. 1 & 2 before.

We found that S are islands in Spanish and Italian in WH dependencies, as in Sprouse et al (2016). However, unlike them, we found that they are also islands in RC dependencies, although there is clear evidence that RC dependencies ameliorate island violations. Our results suggest that the factorial definition of islands should be revised to investigate S islands in Spanish and Italian, since a super-additive interaction cannot be found due to the unacceptability of O subextraction in these two languages, in contrast with English. In sum, the present study contributes to enlarge the growing body of evidence concerning the variation of S islands across and within languages (see, for example, Polinsky et al. 2013).

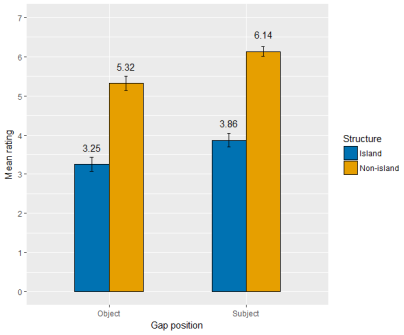


Fig. 1. Mean ratings for Spanish RC dep. (Exp. 1)

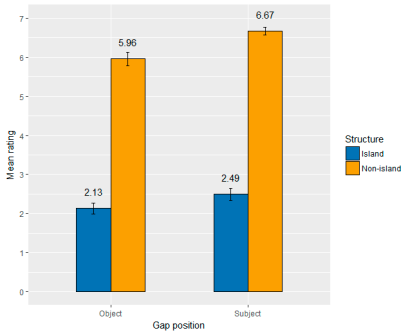


Fig. 2. Mean ratings for Spanish WH dep. (Exp. 2)

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Social Network Limits Language Complexity

MATTHEW LOU-MAGNUSON, LUCA ONNIS
Nanyang Technological University

Linguists have long noted that rich morphological patterns tend to appear in languages spoken by small groups more than larger ones (Evans, 2009), and some have suggested that smaller social groups are simply better at supporting the kinds of innovation that lead to these developments (Trudgill, 2001 & Nettle, 2012). In addition, languages seem to favor syntactic means over morphological ones as they grow in size. Indeed, empirical evidence suggests the typological patterning that languages display may be connected to aspects of the social network of the speakers (Bromham, 2015). Specifically, languages with smaller and more isolated speaker populations tend to make much greater use of morphology than those with larger and more wide-spread populations.

However, beyond correlational evidence, a mechanistic account of how languages gain and maintain complexity is lacking. A major limitation with extant approaches is the assumption that language changes diffuse like diseases (Ke, 2008). Under these accounts, innovations are like viruses, and contact with someone else infected with the innovation causes one to become infected themselves. However, while language change certainly depends on contact with others, grammatical innovation does not spread like a virus, but is instead the result of social learning (Nettle, 2012). Thus, the mechanisms whereby the pattern of connectivity between speakers influence language change, and realistic modeling of usage-based evolution of a language need further elucidation.

To examine mechanistically this connection between social and language structure, we propose a novel agent-based model of grammatical innovation. Rather than learning through instant, infectious contact, agents update their knowledge via a usage-based process where innovation happens through intergenerational transfer. We test two social typologies, one that mimics the social structure of small hunter-gather groups, and the other that of hierarchical, stratified societies. Using complex network methods we identify global transitivity as a physical parameter of social networks critical for developing morphological structure, and hubs associated with scale-free networks as inhibitory, encouraging syntactic composition instead. Results from our simulations support the hypothesis that topologies typical of small human populations promote the development of morphological structures, while those of larger communities lack such capacity, and may in fact lead to inhibitory conditions that encourage the shift to syntactic over morphological patterns. Thus we offer the first causal explanation for the correlation between the grammatical patterning and social properties of a community.

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Semantic transparency in a compositional perspective: a novel framework for compound processing

Marco Marelli, University of Milano-Bicocca, Italy
Fritz Günther, Universität Tübingen, Germany

While some compounds, such as *shorebird*, are semantically transparent, others, such as *ladybird*, are semantically opaque. Typically, this semantic transparency (ST) has been operationalized from a relatedness perspective, where ST depends on the relation between a compound meaning and the meanings of its constituents as independent units. However, such an approach falls short in capturing the compositional side of compounding, a morphological process whose main purpose is generating new meanings. We argue that compositionality, which describes how accurately an actual complex-word meaning can be predicted from the way its constituents are combined, is a crucial determining component of ST. In the present work, we demonstrate that compositionality plays an important role in compound processing.

We use the CAOSS model, a compositional model for distributional semantics, to compute compositional representations for compounds. In CAOSS, word meanings are represented as vectors encoding lexical co-occurrences from a text corpus. A compositional procedure is applied to these vectors: given two constituent words *u* and *v*, their composed representation can be computed as $c=Mu+Hv$, where M and H are weight matrices estimated from corpus examples. The matrices are trained using least squares regression, having the vectors of the constituents as independent words (*car* and *wash*, *rail* and *way*) as inputs and the vectors of example compounds (*carwash*, *railway*) as outputs, so that the similarity between $Mu+Hv$ and c is maximized. Once the two weight matrices are estimated, they can be applied to any word pair in order to obtain meaning representations for their compositional meaning (i.e., productive usage of compounding). Compositionality is hence operationalized as the similarity between these compositional representations and the observed distributed representations for the same compounds, as induced from a large corpus of natural language. We further compute the similarity between the compound constituents and the compositional compound representations as measures of the constituent contribution to the compositional meaning.

We test the impact of these variables on lexical-decision latencies and fixation-durations in sentence reading. For both lexical-decision times and first-fixation durations, we find facilitated processing if the contributions of both constituents are high, indicating an early effect of constituent semantics. On the other hand, the effect of compositionality dissociates across tasks: in lexical-decision times, a facilitating effect is observed for low values of compound compositionality; conversely, gaze durations are shorter for high values of compound compositionality. These findings show that compositionality is crucial to the understanding of ST effects in compound processing. However, the associated variables can have different effects depending on task demands: when the task does not require a precise comprehension of the word meaning (lexical decision), the additional semantic activation associated to the lack of compositionality boosts response,; when access to the actual, lexicalized meaning of the compound is required (sentence reading), the lack of compositionality leads to semantic competition, hence hindering lexical processing.

Semantic and morpho–syntactic cross-word priming during sentence reading

Katarina Marjanovič, Davide Crepaldi
International School for Advanced Studies, Trieste, Italy

Introduction: Separating between semantic and morpho–syntactic aspects of language processing is challenging. Most studies measure responses to semantic/syntactic violations [1, 3] or involve non–ecological word-by-word presentation, as in self-paced reading [2]. Here we try to disentangle semantics from morpho–syntax in *natural sentence reading*, capitalising on the priming effect in eye-tracking.

Method: We used 160 grammatically correct sentences (e.g., "Bob went out for a run and noticed a *dog* and a *cat* just outside his door") in which a target word is preceded by a prime word ("*cat*" and "*dog*", respectively, in the example). Primes could be either congruent or incongruent, either semantically or morpho–syntactically, making up a 2–by–2 design with four conditions: "Bob went out for a run and noticed [a *dog/a ball/some dogs/some balls]* and a *cat* just outside his door"*.* (Note that the experiment was run in Slovenian, where no determiner is available to cue the reader on morpho-syntax, i.e., the sentence was identical in all conditions up to the prime word.) As illustrated in the example, carrier sentences and target words were the same across conditions.

Results: We applied linear mixed models on first run dwell time (gaze duration) as a function of semantic and syntactic congruency, with subjects and sentence/target ID as random effects. A significant semantic priming effect emerged (p=.02), with no effect of syntactic congruency (p=.29). No interaction emerged either (p=.38), suggesting that syntax does not modulate the semantic effect (fig1). Interestingly, none of this emerged in earlier measures of eye movement behaviour, such as first–of–many fixations (all p>.25), despite the fact that we investigated natural sentence reading and thus parafoveal information was fully available.

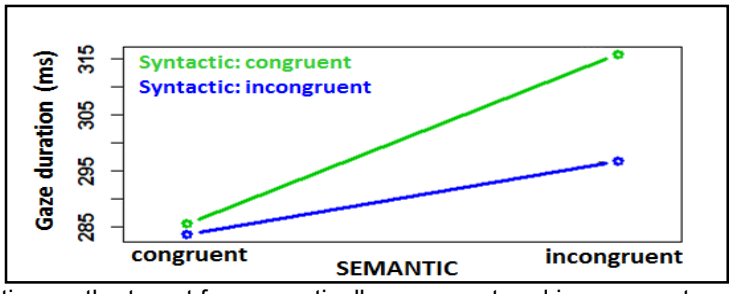


Fig1: Mean gaze duration on the target for semantically congruent and incongruent conditions, in interaction with syntactically congruent (green line) and incongruent (blue line) conditions.

Discussion: The results of this eye-tracking experiment suggest cross–word priming during sentence reading, but only at a semantic level. Syntax does not seem to play any role, not even in modulating the semantic effect. Interestingly, this can only be observed at relatively later stages of processing, as tracked by gaze duration.

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Object attraction and the role of structural hierarchy: Evidence from Persian

Farhad Mirdamadi, Arsalan Kahnemuyipour, Julie Franck

It has been suggested that attraction, i.e., the erroneous agreement of the verb with an element that is not the controller, arises from the incorrect retrieval of the controller from memory through a process of cue-based retrieval (Badecker & Kuminiak 2007). Subject retrieval cues may involve semantic features, nominative case, or structural cues like c-command (Alcocer & Phillip 2012). Similarity-based interference arises when NPs other than the subject share some of these features. Indeed, weaker attraction was observed when the subject and the attractor were unambiguously case-marked (e.g., Lorimor et al. 2008). Preverbal accusative clitics, which occupy a position of c-command in French, were found to generate stronger attraction than dative clitics, which occupy a position of precedence (Franck et al. 2010). However, Hartsuiker et al. (2001) found weaker attraction with preverbal objects than with PP modifiers, which occupy a position of precedence in Dutch. Dutch is an SOV language and, in contrast to French, the contrast was not minimal: it involved a subject modifier and an object. The present study tests the same contrast as in French in Persian, an SOV language. The accusative in Persian takes an object marker (–ra), absent on datives, and moves to a c-commanding position (Kahnemuyipour 2009). This allowed us to assess the role of a morphological cue, -ra, and that of a structural cue, c-command. If–ra marking influences controller selection, like case markers do, we predict weaker attraction in –ra marked accusatives than datives. If only c-command has an effect, stronger attraction is expected with c-commanding accusatives than with datives. If both cues play an equal role, similar attraction is expected in both conditions.

Test sentences (N=128) were built crossing two variables: number Match between the subject and the object (Match vs. Mismatch) and Object type (Accusative vs. Dative). The procedure involved verb selection within a Rapid Serial Visual Presentation paradigm (Staub 2009). Reading times and accuracy proportions were analyzed with (generalized) linear mixed-effects models. We found a main effect of Match ($p<.001$), with more errors in the mismatch (M=13%) than in the match condition (M=10%), and a significant interaction with Object type ($p<.05$), attesting to a stronger effect of Match for accusatives than datives. A main effect of Match was also found on RTs, with slower responses in the mismatch (M=1582ms) than in the match condition (M=1346ms), but no interaction with Object type.

The stronger attraction effect found with accusatives than datives replicates results from French with full NPs and in an SOV language. It supports the role of c-command in the hypothesized cue-based process of controller selection: the c-commanding accusative object triggers more attraction because it is more subject-like. Surprisingly, morphological -ra marking does not appear to reduce attraction, in contrast to case. We suggest that this is due to the fact that, in contrast to c-command or nominative case marking, which are positive cues for subject identification, –ra is a negative cue that only allows for object identification (Fodor & Inoue 2000). To sum up, our results bring further evidence that agreement computation breaks down along hierarchical structure and that the grammatical encoding system uses structural cues in the process of controller selection.

Vietnamese referential forms in spoken and written narratives

Binh Ngo and Elsi Kaiser – University of Southern California (binhnngo@usc.edu)

Speakers' choice of referential form is sensitive to entities' salience/prominence. Salience-hierarchical approaches (Givón'83; Ariel'90; see also Gundel et al.'93) suggest that salient entities are referred to with more reduced forms (null pronouns>overt pronouns>NPs). Furthermore, Italian and Spanish data show that null pronouns prefer subject antecedents and overt pronouns prefer objects (Carminati'02; Alonso-Ovalle et al.'02), in line with claims that salience is related to grammatical roles. This division-of-labor, however, is not apparent in Chinese and Japanese, where both null and overt tend to refer to subjects (Simpson et al.'15; Ueno & Kehler'16). Crucially, most prior work on null vs. overt pronouns has focused on *subject-position pronouns* (as Italian and Spanish lack nulls in non-subject position) with the exception of work on parallelism (e.g. Chambers & Smyth'98) though this work has not investigated the null/overt distinction in depth. To better understand the referential behavior of null vs. overt pronouns, we examined *speakers' production of referential forms in both subject and object positions in written and spoken narratives in Vietnamese*, which allows null and overt pronouns in both positions. Looking at written and spoken modalities also allows us to test claims that referential form use varies with modality (Chafe & Tannen'87, Biber et al.'99).

Native Vietnamese speakers (n=20) watched the Pear Story film (Chafe'80) about a boy stealing pears. They then recounted the story as if talking to a friend who hadn't seen the film, *first verbally, then in writing*. For reference to humans, we analyzed **(i)** the *form of the current mention* (null, overt, NP) and **(ii)** *its current and preceding grammatical roles*, which yielded four configurations (see Fig.1; $Subj_{prec}$-$Subj_{curr}$, $Subj_{prec}$-Obj_{curr}, Obj_{prec}-$Subj_{curr}$, Obj_{prec}-Obj_{curr}).

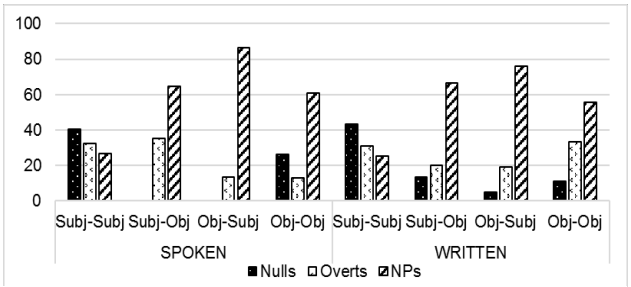


Fig.1. Referential forms in four configurations.

Results: Overall, we found no differences in the patterns of the four configurations between spoken and written tasks (p's=n.s.); thus, no modality effect. Also, $Subj_{prec}$-$Subj_{curr}$ was most frequently produced (>75%).

The four configurations differ in referential form production: **Subject parallelism (**$\mathbf{Subj_{prec}}$**-**$\mathbf{Subj_{curr}}$**)**: People mostly produce pronouns (null+overt > NPs, p's<.01, no difference between nulls/overts) in both modalities. The distribution of anaphoric forms in $Subj_{prec}$-$Subj_{curr}$ differs from the other three, where speakers mostly produced NPs (p's<.01). When a preceding subject is demoted to object (**$\mathbf{Subj_{prec}}$-$\mathbf{Obj_{curr}}$**) or a preceding object is promoted to subject (**$\mathbf{Object_{prec}}$-$\mathbf{Subj_{curr}}$**), speakers mostly produce NPs in both modalities (64%-86%). Thus, changes in grammatical role (lack of parallelism) triggers NP use. Strikingly, the **Object-parallelism (**$\mathbf{Obj_{prec}}$**-**$\mathbf{Obj_{curr}}$**)** configuration, although involving mostly NPs (>55%), has more pronouns (spoken: null pro, written: overt pro) than configurations lacking parallelism.

In sum, our Vietnamese data suggests that (i) the division of labor of null vs. overt pronouns is less clear than standardly assumed, and that (ii) *both* subjecthood and parallelism guide pronoun use: In both modalities, Subj-Subj yields mostly pronouns while the other configurations have mostly NPs. Interestingly, hints of parallelism effects also emerge in Obj-Obj, which has more pronouns than non-parallel configurations. This study highlights the importance of considering grammatical roles in both the current and preceding utterances.

Triadic communication: Do human speaker and virtual agent listener gaze both influence a listener's language comprehension?

Eva M. Nunnemann [1], Kirsten Bergmann [1], Pia Knoeferle [2]
[1] CITEC, University of Bielefeld, Germany
[2] Department of Language and Literature, Humboldt University of Berlin, Germany

In face-to-face communication, speakers occupy a crucial role in a dialogue. While they directly address their listeners, they might also indirectly address passive bystanders (e.g. [4]). A speaker's gaze cues provide further information for the listeners, as the speaker looks at potential referents before even mentioning them. Thus, listeners can anticipate or disambiguate them early in the utterance (e.g. [1]). Previous research showed that they are able to anticipate referents even when the speaker is a virtual agent (e.g. [3]). Our study investigated whether human listeners only benefit from human speaker gaze or whether they can also exploit the gaze cues of a bystander, such as a virtual agent listener following speaker gaze. Participants saw short video clips depicting a static scene with three characters on a screen. On one side of this screen a human speaker was visible and on the other a virtual agent listener. Participants' eye movements were recorded while they listened to the speaker's German SVO sentences describing an interaction between two of the three characters on the screen, e.g. *Der Kellner beglückwünscht den Millionär* ('The waiter congratulates the millionaire'; materials from: [2]). While the human interlocutor displays speaker gaze behaviour, the virtual agent follows her gaze at a short delay showing the typical gaze behaviour of a listener. After each trial, a schematic depiction of the three characters and their interaction appeared on the computer display and participants verified whether that template matched the sentence from the preceding video. In the experiment we manipulated: (1) whether the human speaker uttering the sentences was visible, (2) whether the agent listener was visible, as well as (3) whether the template matched (vs. didn't match) the spoken sentence. The main question under investigation was, whether participants follow only human speaker or agent listener gaze, both, or neither of the two types of gaze. The setup also allows for testing whether participants follow a virtual agent's gaze even if he is only a passive listener. Moreover, we can examine whether one gaze cue (e.g. speaker gaze) is preferred over two gaze cues (human speaker and agent listener gaze), or not. Participants solved the verification task very well across all conditions. Their responses were faster for matches than mismatches and slower for trials where the agent was visible than for those where he was absent. The eye tracking results suggest that participants looked more at the NP2 referent (e.g. the millionaire) in those conditions where the human speaker was visible than in the other conditions. In conclusion our study showed that only human speaker but not agent listener gaze guided attention during spoken language comprehension. While speaker gaze proved to be beneficial in face-to-face communication, the gaze of an agent bystander did not and his presence even affected task performance negatively.

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Second-language reading patterns are associated with a statistical learning bias

LUCA ONNIS, Nanyang Technological University, STEFAN FRANK, Radboud University, HONGOAK YUN, Konkuk University, MATTHEW LOU-MAGNUSON, Nanyang Technological University.

Human languages are learnt and processed in real time. Speech is the ultimate fleeting experience, as it dissipates as soon as it is produced. And while printed text is more stationary, proficient readers process words sequentially at a very fast pace, with relatively few gazes spent looking back to reread previous words. The inherent fleeting nature of language and the great efficiency that humans exhibit in learning and using languages suggest that the brain must recruit mechanisms employed for processing sequential information. These mechanisms may involve the ability to unconsciously track and extract patterns of regularities across sensory modalities, and to abstract over these patterns – an ability often subsumed under the term statistical learning (SL).

Here we investigated the extent to which SL ability is associated with adult language processing. In particular, we asked whether SL proclivities towards relations that are more informative of English are related to efficiency in reading English sentences by native speakers of Korean.

A previous Artificial Grammar Learning study found a language-specific "statistical learning (SL) bias": English-speaking adults segment an ambiguous speech string such that words' transitional probabilities are consistent with the head-initial structure of English, whereas Korean-speaking adults favour a different segmentation, consistent with the head-final structure of Korean (Onnis & Thiessen, 2013).

In the current study, we investigate how this SL bias affects second-language processing. Using the above mentioned AGL task, we assessed the SL bias of 58 adult Koreans who were advanced speakers of English as a second language. The same participants then performed a self-paced reading task on a general sample of English sentences. Word-reading times were analysed by linear mixed-effects regression, including as predictors: base frequency and forward transitional probability of the word, participant's SL bias and L2 proficiency, as well as several covariates.

We found that individuals with a more "English like" SL bias more efficiently incorporated statistical regularities during online reading, in that their word-reading times were significantly more sensitive to the words' forward transitional probability as opposed to base frequencies. These findings further support the view that statistical learning skills underlie not only language learning in childhood, but also second language processing in adults.

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Referential form and implicit causality

Duygu Özge[1], Joshua Hartshorne[2], Jesse Snedeker[3]

Middle East Technical University[1], Boston College[2], Harvard University[3]

How do listeners interpret speaker's choice of anaphoric form? According to Centering Theory, speakers use reduced forms when both the anaphoric from and the antecedent are the topics of consecutive sentences.[1] This prediction has been a fixture in a number of theories,[2] but was recently challenged in a cross-linguistic comprehension study focusing on implicit causality (IC).[3] The study found stimulus bias, regardless of whether the pronoun is dropped, both in the stimulus-experiencer verbs (verbs where the subject is the stimulus causing a psychological state in the object –the experiencer; *frighten-type*) and in the experiencer-stimulus verbs (verbs where the experiencer has the subject role and the stimulus has the object role; *fear-type*). Yet, anaphoric form was not manipulated within language in this study. A recent study on Italian IC verbs found a stimulus bias regardless of anaphoric form.[4] Japanese speakers, however, showed a stimulus-bias for frighten-type verbs and an experiencer-bias in fear-type verbs in zero-pronoun condition in explanation continuations, whereas they showed a stimulus bias for both conditions in overt pronoun and free prompt conditions,[5] which is puzzling. Despite systematically manipulating the anaphoric form, Italian and Japanese IC studies were based on sentence-continuation.

We test comprehension systematically manipulating anaphoric form and verb-type within a language. We investigate whether experiencer or stimulus is selected as the antecedent of an anaphor in IC verbs in Turkish. We also test an intuition-based hypothesis that Turkish IC verbs result in an experiencer bias.[6] If true, this would challenge the assumption that IC biases are consistent across languages.[7,8] However, this intuition was based on examples with (+) human experiencer and (-) animate stimulus. If there is an experiencer bias, [6] we expect the subject to be selected as the antecedent of the ambiguous pronoun in fear-type verbs and the object to be selected in frighten-type verbs; if there is a stimulus bias, [3, 4] we expect the object to be selected in the fear-type verbs and the subject to be selected in frighten-type verbs. In two rating studies,[8] participants read 24 sentences with frighten-type and fear-type verbs. Each sentence had a clause conjoined with 'because' that had an ambiguous anaphor (Study-1:full-pronoun; Study-2:zero-pronoun) ending with a non-word adjectival predicate (*Bahar dazzles Ceren a lot because she is extremely dax*). Participants chose the referent for this non-word (i.e.,*Who is dax?*). There was a greater subject preference in frighten-type verbs compared to fear-type verbs both in Study-1 (full-pronoun) ($p<.001$) and in Study-2 (zero-pronoun) ($p<.001$). Pronoun omission significantly increased the subject preference only in fear-type verbs ($p<.001$). The anaphor was not resolved towards the experiencer when the referents were controlled for animacy.[c.f.,6] Our findings corroborate with a cross-linguistic tendency where frighten-type verbs are strongly biased towards the stimulus regardless of form. [4,7] However, different from previous studies we found that fear-type verbs are more malleable and their causality biases change in line with the form of the anaphor. This pattern challenges all current theories of anaphora.

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PASSIVES ARE NOT ALWAYS MORE DIFFICULT THAN ACTIVES

Paolazzi, C.L., Grillo, N., & Santi, A. - caterina.paolazzi.11@ucl.ac.uk

Passives are considered more difficult than actives due to greater offline errors. Two main accounts of this difficulty include: (1) a derivational relation between actives and passives [1] and (2) an agent-first heuristic [2]. There is a problem for these accounts: passives are read numerically faster online [3,4]. Our lab confirmed these effects, at significance, while simultaneously collecting online (self-paced reading, SPR) and offline (comprehension question, CQ) measures. We also investigated an interaction between passivization and predicate type (event/state). English eventives produce verbal passives, while stative passives are temporarily ambiguous between adjectival and verbal interpretations [5]. We predicted passivization to be more errorful for statives. A numerical, but not significant interaction was observed. Two main questions emerged: (1) Why are passives more errorful? and (2) Why are passives processed faster? Two experiments targeted the former question considering 2 sources: Working Memory (WM) and task-related effects.

Experiment 1 investigated a WM-based explanation of the offline passivization effect. Our participants greatly varied in this effect (SEM 17%; ¼ better on passives; ¼ no difference) and differences in comprehension accuracy have often been related to WM [6]. Moreover, Ferreira [2] predicts the agent-first heuristic to be used more, the lower the WM. An SPR task with CQs was followed by both an n-back and sentence span task (n=96). For comparison, we used the same design as above: 2 within, syntax(active/passive) by 2 between, predicate(eventive/stative). We replicated online (passives faster across several regions, $p<.001$) and offline (passives more errorful, $p<.001$) effects. WM correlated with overall CQ performance (marginal in accuracy, $p=.06$; RTs, $p=.01$), but not with the difference in accuracy (actives-passives) nor SPR data. Online and offline measures, again, dissociate and we find no support for a WM-based explanation of the offline effect.

Experiment 2 looked to a task-related explanation of this effect. In Exp. 1, the CQ assessed thematic roles and was consistently presented in the active form. In Exp. 2, we balanced the CQ for active and passive form across conditions, thereby minimizing condition-biasing strategies and/or demands on processing (i.e., lack of priming) in completing the task. Rather than SPR, we collected another offline measure, sensitive to overall syntactic form/processes: acceptability judgments. Design/stimuli were the same as Exp. 1 (n=96). There was no effect of syntax, in either acceptability or accuracy, but a marginal syntax*predicate interaction in accuracy ($p=.09$), in the predicted direction (effect of syntax in statives only, $p=.005$). This suggests the passivization effect in Exp. 1 arose from different sources within each predicate type.

In contrast to the 2 main accounts of passives [1,2], we show they are not overall more difficult to parse and/or interpret. Rather, passivization is susceptible to complexity effects during tasks that are dependent on interpretations of complete representations (i.e., in CQ, but not SPR or acceptability). Factors contributing to its susceptibility include task-related effects (i.e., biasing strategies or processing demands) and predicate semantics.

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Expanding Competition Space: The Influence of Foreign Accentedness on Lexical Competition

Vincent Porretta and Aki-Juhani Kyröläinen
University of Alberta, University of Turku

Foreign-accented speech can be challenging to understand as it constitutes a highly variable speech stream that can lead to differences in processing and comprehension. The presence of an accent has been likened to noise that the listener must handle; however, it is still unclear how spoken word recognition is influenced by foreign-accented speech. It has been shown that noise increases lexical competition (Brouwer & Bradlow, 2016) and there is some evidence that competition may differ between native and non-native speech (Chan & Vitevitch, 2015). If the accented signal partially matches (and thus activates) several candidate words, this competition may increase as foreign accentedness increases. The current study examines how foreign-accented speech influences the underlying activation of lexical competitors.

This study utilizes 40 monosyllabic English words each spoken by one native English and nine native Mandarin talkers. In two previous studies these tokens were rated for foreign accentedness (Porretta et al., 2015) and transcribed for intelligibility (Porretta & Tucker, 2015). Examining the transcription accuracy, we calculated the number of unique words produced for each token. The number of unique responses can be taken as an indication of the lexical competitor space induced by the token. To test the relationship between foreign accentedness and lexical competition, we model the number of unique responses to a given token as a function of its foreign accentedness rating.

Generalized additive mixed-effects modeling (GAMM; Wood, 2016) was used to implement a Poisson model in order to examine how foreign accentedness influences the number of unique responses. GAMM allows for a possibly nonlinear effect of accentedness. Lexical frequency and neighborhood density were included as control variables, along with random effects for word and talker. The results indicate a significant, nonlinear effect of foreign accentedness, such that as accentedness increased, the number of unique responses also increased, though this increase was steeper for stronger accents. Competition space (lexical competition) thus appears to expand as accentedness increases, similar to the effect seen for speech in noise. However, as this is offline measure (and approximation) of competitor activation, eye-tracking data using the Visual World Paradigm is currently being collected. Preliminary analysis indicates that looks to competitor words increased over time also as a function of accentedness. This suggests that foreign-accented speech may in part be difficult to understand due to the activation of additional, and possibly spurious, lexical competitors.

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A visual-world priming study of Gricean implicatures

Alice Rees and Lewis Bott, School of Psychology, Cardiff University

The basic meaning of a sentence can be enriched by considering what the speaker did not say, but could have done (Grice, 1975). For example, "John's essay was *good*," implies that John's essay was *not excellent*. The classical explanation of implicatures assumes that the listener uses Gricean principles of cooperation. However, it is also possible that implicatures are derived using a pragmatic frame imposed onto the input (see Bott & Chemla, 2016; Rees & Bott, 2017) in the same way that syntactic information is acquired by imposing a syntactic frame (e.g. Pickering & Branigan, 1998). In this study we test this hypothesis.

One of the hallmarks of syntactic frames is that they can primed (e.g., Branigan & Pickering, 2017). If implicatures use representational frames, they should also be primeable. Indeed, some evidence for this exists already. Bott & Chemla (2016) and Rees & Bott (2017) showed that implicatures can be primed in a sentence-picture matching task. However, this task relied on metalinguistic interpretation judgements and may reflect high-level strategies rather than normal linguistic processes. In our study we tested whether implicatures can be primed but instead of a matching task, we used a visual world structural priming paradigm (see Thothathiri & Snedeker, 2008).

Experiment. N = 42 Participants saw sets of four cards [A] [AB] [CD] [E] (Fig 1) and heard an auditory description of one. Their task was to identify the card being described. Primes referred to either the [A] or [AB] cards. Since the A object was repeated in two cards, when primes referred to the [A] card ("The card with the [A]") the description was ambiguous between the [A] and [AB] cards. In order to select the correct card participants were required to make an implicature (*The A and nothing else*). When primes referred to the [AB] card ("The card with the [B]") this was unambiguous and no implicature was required. Target trials followed prime trials and in critical trials, always used an [A] card as the referent. If implicatures can be primed then participants should identify the referent in target trials faster after having made an implicature than not. This would be characterised by earlier looks to the referent following [A] primes than [AB] primes.

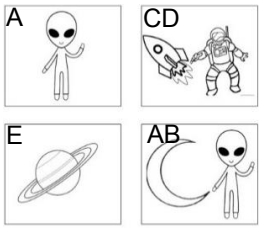


Figure 1. Example trial

Results and discussion. A repeated measures ANOVA was run from referent onset to 1 second after. Time and prime ([A] or [AB]) were factors. There was a significant interaction between time and prime (F_1 (40, 1440) = 1.51, p = .022, F_2 (40, 1240) = 1.62, p = .009), such that there were looks to the referent earlier following the [A] prime than the [AB] prime, consistent with the claim that implicatures can be primed.

These results suggest that a meaning-based representation corresponding to an implicature remains active across time, i.e a pragmatic frame. In future work we address whether linking pragmatic frames to the lexicon can explain the diversity associated with rates of implicature (van Tiel et al, 2014) by testing whether a lexical boost arises when prime and target overlap.

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Lexical effects in speech motor control do not trigger perceptual learning

Eva Reinisch, Nikola Anna Eger, Philip Hoole
Ludwig Maximilian University Munich, Germany

A recent tool in the study of speech motor control is online-altered auditory feedback (OAF). As participants produce speech, their speech signal is filtered and manipulated before being fed back via headphones in close-to-real time. The mismatch in intended production and perception triggers articulatory compensation. If participants hear themselves say "hid" instead of the intended word "head" they tend to shift their production towards "had". Critically, the magnitude of compensation relates to the individuals' perceptual boundaries [1] and the lexical status of the intended vs. perceived word [2]. Compensation is stronger if the percept due to altered feedback is a lexical neighbor of the intended word.

The present study replicated the effect of lexical vs. non-lexical neighbors in German and assessed whether this has repercussions on perception as measured in phonetic categorization of the critical sound contrast. 30 female native speakers of German produced the words *Deck* (/dɛk/ "deck$_{[nautic]}$") and *Pech* (/pɛç/ "bad luck") 160 times each (order counterbalanced). The lexical manipulation was that *Deck* has a high-frequency lexical neighbor *dick* (/dɪk/ "thick/fat") whereas *[pɪç] is not a word in German. After 40 baseline trials the first and second formants of /ɛ/ were gradually shifted apart over 50 trials to a maximum change of 180 mel for F1 and 90 mel for F2. Without compensation, this should result in perceiving a vowel close to /ɪ/. After 30 trials under maximal OAF, 40 trials without OAF served as washout phase. To test for a possible shift in perception, participants categorized a 17-step [fɛp]-[fɪp] nonword continuum before between and after the two blocks with the two words. The distance between the endpoints matched that of the vowels under maximal perturbation.

We hypothesized that, if listeners compensate little (as in the *Pech* block) and therefore are exposed to auditorily ambiguous tokens, their perception may show learning effects similar to [3]. That is, when listeners are repeatedly exposed to auditorily ambiguous tokens in unambiguous contexts they later categorize auditorily and contextually ambiguous tokens in line with the previously intended category. A pilot experiment suggested that the percept from OAF could be sufficient to trigger such a shift in perception despite the mismatch in articulation. No such effect would be expected for strong compensation (here: triggered by the lexical neighbor in the *Deck* block) because then the percepts would be relatively good tokens of the intended sound.

Results showed more compensation for OAF when a lexical neighbor was present. However, perceptual learning for the no-neighbor block could not be found. To the contrary, more /ɪ/ - not /ɛ/, as would be expected of perceptual learning - responses were given. For the neighbor condition, categorization responses were extremely variable with some participants shifting their perceptual boundary in opposite directions. A follow-up experiment is being designed to further explore this relation between lexical effects in speech motor control and subsequent effects on perception.

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Collocational knowledge in children acquiring English as a Second Language

Nick Riches, Carolyn Letts*, Hadeel Awad*, Rachel Ramsey†, Ewa Dabrowska†*
* Newcastle University, † Northumbria University

Adults acquiring English as a second language (L2) make frequent collocational errors, e.g. *make attention* (Nesselhauf, 2003). Such errors occur in relatively advanced learners and may thus reflect underlying learning mechanisms. A potential cause is limited L2 exposure, or alternatively, an analytic learning style focusing on structure, and mapping directly between the L1 and L2 while overlooking multi-word combinations (Wray & Perkins, 2004). Such an analytic learning style is evidenced by L1 transfer errors which occur both with collocations (Nesselhauf, 2003), and morphological / syntactic items. This contrasts with the more holistic learning style of child L1 learners, whose early utterances are formed from prefabricated chunks (Dąbrowska & Lieven, 2005; Wray & Perkins, 2004).

In contrast to adults, almost nothing is known about collocational ability in children acquiring English as an L2 (EL2). On a practical level, it is important to investigate this population as it is growing rapidly, and these children have complex educational needs. On a theoretical level, it is important to determine whether EL2 children learn analytically, like their adult L2 counterparts, or holistically like younger L1 learners. This study addressed these issues by testing children's collocational knowledge.

A novel collocations test was administered to 34 children learning English as an L1 (EL1), and 26 EL2 children (mean age 6;3). The experimenter produced a collocation plus distractor in randomised order (e.g. *big and small* / *small and big*) and participants were asked to choose the item which sounded 'good' with the help of picture prompts. Further assessments of receptive vocabulary (BPVS) and receptive syntax (TROG) were administered. Finally, a questionnaire was used to gauge the children's English exposure.

The EL2 children performed significantly worse on all assessments, with a larger effect size for the collocations task ($d = 1.79$) than receptive syntax ($d = 1.67$) or vocabulary ($d = 1.59$). There was little evidence for an association between collocational knowledge and language exposure. Collocational knowledge was significantly associated with vocabulary and syntax in the L1 group ($r = 0.50^{**}$ / $r = 0.52^{**}$). However, in the L2 group, collocational knowledge was significantly associated with vocabulary but not syntax ($r = 0.37^{**}$ / $r = 0.26$). Correlations between vocabulary and syntax were significantly weaker in the EL2 group than the EL1 group ($r = 0.70^{***}$ versus $r = 0.35$, $p = 0.035^{*}$).

The study found that collocational knowledge in EL2 children is limited like their adult counterparts. Though exposure is likely to play a role, there was little evidence for this. By contrast, there was evidence for an analytic learning style attested by the weak association between collocational knowledge and syntactic abilities in the EL2 children. This indicates a limited role for chunk-learning in L2 syntactic acquisition. The strong association between collocational knowledge and syntax in the L1 children supports accounts of language acquisition which argue that this process is chunk-dependent (Dąbrowska & Lieven, 2005). Findings of an analytic learning style in child L2 learners suggest that language aptitude assessments may have good predictive validity for these children.

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Incidental learning of graphotactic patterns in word-initial and rime-level units: Evidence from English and Turkish

Anna Samara[1,2], Daniela Singh[2], & Elizabeth Wonnacott[2]
[1]Liverpool University; [2]University College London

Memorisation and explicit rule learning skills do not suffice for competent spelling skill to develop-at least in inconsistent orthographies such as English or French. A few previous studies have demonstrated that young children's spellings *also* conform to untaught graphotactic constraints (e.g., Pacton, Perruchet, Fayol, & Cleeremans, 2001) and have postulated that statistical learning processes may underlie this ability (Kessler, 2009). For instance, a pattern that spellers rely on from a young age is that of graphotactic conventions for permissible positions of letters in sequences (e.g., ck is not legal in word beginnings). Spellers are also sensitive to some untaught constraints on permissible letter contexts in their orthographic system (e.g., in English, consonantal coda spellings are more likely to be doubled when preceded by single-vowel spellings, e.g., Jeff, than double-vowel spellings, e.g., deaf) (Hayes, Treiman, & Kessler, 2006).

In line with this view, Samara and Caravolas (2014) have shown that 7-year-olds incidentally learn and generalize over novel restrictions on permissible letter combinations (e.g., t can occur with o with but never with e) when these are embedded both in word beginnings and ends. We replicate this work and also ask: Are both word contexts necessary for graphotactic learning to occur and, if not, are they both equally beneficial to learners?

Method: Sixty 7-year-old English-speaking children and 49 7-year-old Turkish-speaking children were exposed-over two brief sessions-to written CVC pronounceable nonwords (e.g., tep) that exemplified novel constraints on permissible letter combinations, embedded either at the beginning of the stimuli (i.e., in word-initial, consonant-plus-vowel units) or at the end of the stimuli (i.e., in rime-level, vowel-plus-final-consonant units). At test, children made legality judgements ("*Can this word exist in the language?*") for novel nonwords that either were or were not graphotactically permissible.

Results: Discrimination ability at test was above chance, suggesting learning of the graphotactic constraints-both for developing learners of the inconsistent English orthography and those of the more consistent Turkish orthography. We found no evidence of greater learning for word-final than word-initial constraints in either linguistic context, which goes against theoretical proposals as to the different status of rime-level units in reading development (Kessler & Treiman, 1997). Ongoing experiments in our lab explore the extent to which graphotactic learning is underpinned by phonotactic learning by manipulating these factors in written and/or spoken stimuli.

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Is referential overspecification a BIG problem, or just a problem?

Raheleh Saryazdi, Agatha Rodrigues, Craig G. Chambers, *University of Toronto*

In natural discourse, speakers sometimes produce referential descriptions that are overinformative (e.g., containing unnecessary modifiers). Here we explore the immediate impact of referential overspecification on comprehension in a group of younger and older adults, as well as potential downstream consequences on language processing.

As background, although overspecified descriptions are in principle Gricean violations, they are sometimes argued to be generally facilitative (Arts et al., 2011), or facilitative with certain kinds of modifier types/contexts (Rubio-Fernandez, 2016). Conversely, other studies have shown negative effects of overspecification on comprehension (e.g., Davies & Katsos, 2013; Engelhardt et al., 2011). Importantly, all studies on this topic have, to our knowledge, been conducted with younger listeners. There are reasons, however, to speculate that the outcomes may differ with older adults. For example, in referential communication tasks, older adults tend to produce more words per description than younger adults (e.g., Horton & Spieler, 2007) and more off-topic language (Arbuckle et al., 2000), suggesting they might be more tolerant of referential overspecification as listeners. Another possibility is that, due to older adults' greater experience with language, the deviation from Gricean norms may lead overspecification to carry a greater cost than for younger adults. A related consideration is the issue of general age-related slowing (Salthouse, 2000). If overspecification is disruptive, this may entail a lingering downstream penalty for older adults as processing systems work to "recuperate".

In a visual world experiment, 24 younger and 24 older adults (M_{age}=19.5 vs. 75.5) followed spoken instructions relating to a display of five objects (e.g., *Select the unlit cigar*). On critical trials, the target was accompanied by either a contrasting object (e.g., a lit cigar) or an unrelated item, making the modifier either **felicitous** or **superfluous**. We first examined the immediate impact of the modifier on button press latencies (buttons corresponded to the location of screen objects) and eye movements. Consistent with the broader aging literature, older adults were significantly slower than younger adults in button presses ($p < .001$). More important, however, were the across-condition differences. Although all listeners were (422 ms) slower to identify targets in the superfluous condition, there was an interaction ($p = .033$) reflecting a larger overspecification penalty for older adults (548 ms). Interestingly, gaze latencies also showed slower target identification in the superfluous condition (137 ms penalty, $p = .001$), but in this case the effect was equivalent for both age groups. This suggests the button-press pattern arises from cascading effects of older adults' slower motor programming/execution, rather than differences in language processing. Next, to examine whether overspecification disrupted downstream processing, we measured fine-grained aspects of spoken word recognition for the noun in an immediately subsequent instruction relating to the same visual display (e.g., *Select the wheel*). These processing measures can also gauge the likelihood that listeners might be expecting a superfluous adjective. However, aside from slower button presses for older adults (again), targets were identified quickly, and the measures reflected only known lexical effects (e.g., word frequency, p's < .001), which did not vary by age.

In conclusion, although overspecification can incur an immediate penalty on real-time referential processing, the effects are fleeting in nature and do not seem to be moderated by listener age. The results also highlight the importance of using on-line implicit measures with a low metabolic cost to ensure an accurate picture of the effects of aging on real-time language processing.

The cognitive penetrability of grammatical gender information during categorization

Sayaka Sato & Panos Athanasopoulos (Lancaster University)

Whorf's linguistic relativity hypothesis has stirred a lively debate as to whether the languages we speak are responsible for shaping the way we think (Whorf, 1956). In its simplest form, the hypothesis posits that speakers orient their attention to the features encoded within the languages they speak, which serve to emphasize specific aspects of reality. While the debate remains unsettled as to the extent of its influence, more recent assumptions such as the label-feedback hypothesis support the view that language is integrated into general cognitive functions (Lupyan, 2012). Lupyan's (2012) view argues that during perceptual processes, diagnostic features of the stimuli activate a corresponding label (i.e., word) in a bottom-up manner. This label, in turn, works in a top-down manner and feeds back information that may influence perceptual representation.

In the present study, we argue that this label-feedback process may not be restricted to whole words, but may be triggered merely by grammatical features such as grammatical gender. We present two experiments that examined the influence of grammatical gender categories of objects on a task which did not require participants to consciously process verbal information. Given that French integrates grammatical gender in its linguistic system, as opposed to English which does not have a comparable system, we compared French-English bilinguals to native English controls on a non-verbal categorization task. Specifically, we examined the extent to which the grammatical gender of presented object images would be retrieved and used for their categorization.

In the first experiment, participants were sequentially presented with two object images that were manipulated for their (i) conceptual gender associations and (ii) grammatical gender in French. Participants made a categorical judgment on a target female or male facial image as to whether the two preceding objects made them think of the face. Response latencies indicated that the native English controls were sensitive to the conceptual gender association of the objects when making their judgments. On the other hand, French-English bilinguals made use of both conceptual and grammatical gender information of the object to make their judgments. These results showed that both conceptual and grammatical gender information is crucial for bilinguals when attending to tasks that require conscious use of gender information. In the second experiment, the same experimental manipulations were maintained, except that participants did not need to refer to the objects to make their judgments. The results indicated that although the retrieval of the objects' conceptual or grammatical gender information was unwarranted, English controls made use of their conceptual gender information. In contrast, French-English bilinguals relied solely on grammatical gender information of the object primes.

The findings of the study show that linguistic features such as grammatical gender categories provide language speakers with a structural feedback which results in impacting perceivers' perceptual representations. This information is readily available to them, although this information may be irrelevant to the immediate task. We argue that these results show that grammatical information penetrates cognition and provide grounds to support more recent interpretations of the linguistic relativity hypothesis.

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Online incidental statistical learning of auditory word sequences in adults: A pre-registered study

Sengottuvel Kuppuraj[*1], Mihaela Duta[1], Paul A. Thompson[1], Dorothy V. M. Bishop[1]*
*[1]Department of Experimental Psychology, University of Oxford, *kuppuslp@gmail.com*

Statistical learning has been proposed as a key mechanism in grammatical learning, yet to date, studies of statistical learning have largely focused on adults with well-established language skills, using artificial grammars to mimic the process of language learning. Our ultimate goal is to develop a child-friendly statistical learning task using familiar words that could be used to identify individual differences in children's ability to learn sequential patterns in input. To validate the approach, we will present typical adults with auditory triplets of familiar words that have deterministically (TP =1) and probabilistically (TP=.5) predictable events embedded adjacently and non-adjacently while keeping the token frequency of each structure constant in a within subject design. This novel online learning task is followed by an offline guided recall (triplet prediction task) to assess learning of each sequence type. Our goal here is to evaluate the task in adults with specific predictions and to establish effect size of learning indices in this learning paradigm.

The study examines three registered predictions. (i) there will be a grammaticality effect similar to the one reported by Vuong et al. (2016), where patterned dependencies (adjacent and nonadjacent, deterministic and probabilistic) within the same block of stimuli act as 'grammatical' and random triplets act as 'ungrammatical'. (ii) the anticipated order of difficulty, from easiest to hardest, would be deterministic adjacent, probabilistic adjacent, deterministic non-adjacent, probabilistic non-adjacent. We will test this predicted order using an online measure of learning – decrease in RT over blocks, and will also examine effects of adjacency and probability for the offline triplet prediction test. (iii) Finally, we will consider whether an individual's statistical learning capacity is related to short term memory capacity, given that memory constraints have been proposed as a factor influencing statistical learning(Janacsek & Nemeth, 2013).

We used a simulation, with 500 iterations, to explore how sample size related to power, and settled on a sample size of 84, which gives over 90% power to detect a small effect size, r = .16 in each of the four (Block*grammatical condition) interactions (prediction 2), which is of the order of magnitude to be of theoretical interest.

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Processing of Case and Agreement in German Sentences with Word Order Variation: Eye-Tracking Evidence from Four-year-olds

Iryna Sorokovska (University of Potsdam), Christine S. Schipke (University of Potsdam), Flavia Adani (University of Potsdam)

In German, morphosyntactic cues, such as case marking and verb agreement, can play a deciding role for sentence interpretation. The local cue hypothesis (Slobin, 1982) predicts that case morphology should be easier for young children due to its local nature in contrast to a more demanding, distributed verb agreement. Regarding the acquisition of case, the existing studies provide controversial evidence (see Lindner, 2003; Schipke et al., 2012), while even less is known about comprehension and processing of the agreement cue in young children (see ibid.). Furthermore, so far, case and agreement were never tested systematically within the same experiment. In this paper, we examined how 4-year-old German-speaking children employ the case and agreement morphology for interpretation of S(ubject)-V(erb)-O(bject) and OVS sentences by combining an explicit (sentence-picture matching) and an implicit (visual world paradigm) method. We addressed the following research questions: (a) do case and verb agreement facilitate sentence processing and comprehension in 4-year-olds and which of these cues is deployed first and more reliably? (b) are 4-year-olds' comprehension and processing abilities modulated by their grammar and inhibition skills (as measured with two independent tests)?

Thirty-six monolingual German-speaking children (mean age: 4;6) were asked to interpret unambiguously case- (1&2) and agreement-marked (3&4) sentences:

1. *Der Rabe fängt den Hasen* '[The crow]$_{NOM}$ catches [the bunny]$_{ACC}$' (SVO)
2. *Den Raben fängt der Hase* '[The crow]$_{ACC}$ catches [the bunny]$_{NOM}$' (OVS)
3. *Das Schwein fängt die Rehe* '[The pig]$_{SG}$ [catches]$_{SG}$ [the deer]$_{PL}$' (SVO)
4. *Das Schwein fangen die Rehe* '[The pig]$_{SG}$ [catch]$_{PL}$ [the deer]$_{PL}$' (OVS).

The results revealed an at-ceiling performance of 4-year-olds in the SVO condition (M=95% for case, M= 92% for agreement cue) that together with a constant increase of target looks point out that the SVO structure does not pose difficulties for children. The OVS condition, however, turned out to be more demanding. Moreover, we found an advantage for case over agreement (M=58% for case, M=39% for agreement cue). Though children's poor accuracy response in the explicit task suggests that they mostly rely on the agent-first heuristic, their gaze patterns reveal sensitivity to both features during implicit sentence processing. In addition, more advanced grammatical skills resulted in a higher performance on the task independently of the cue, whereas more developed attention inhibition abilities were advantageous for processing of OVS sentences disambiguated by the agreement cue only. We claim that due to a higher cue cost of the distributed verb agreement cue in contrast to the local case cue, it posed a higher memory load for children. In turn, the elicited facilitative effect of the case marking cue as well as the interaction of the agreement cue with the child's inhibition skills provide evidence for the local cue hypothesis.

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Lexical processing of monolingual homophones

Katharina Sternke M.A. & Prof. Dr. Dr. Peter Indefrey, Heinrich-Heine-University Duesseldorf

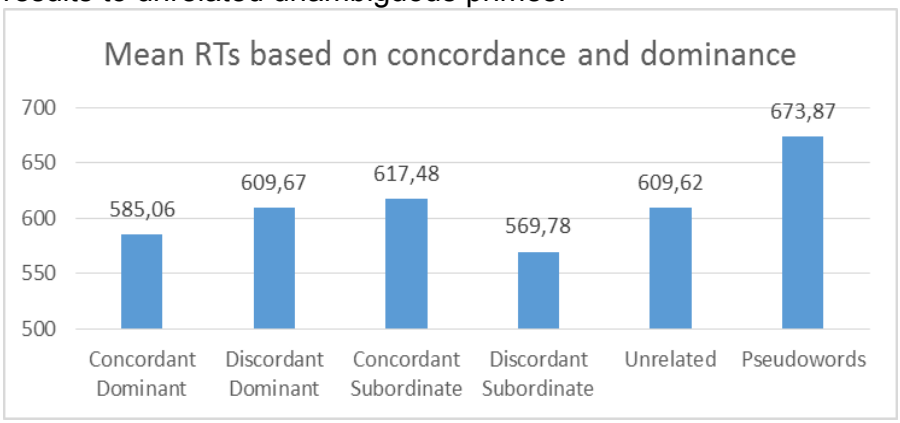
According to Gahl (2008) homophones differ in word length based on their word frequency. This led us to the question whether the perceived word length also plays a role for the identification of the intended meaning of a homophone. Swaab et al. (2003) conducted an ERP study dealing with ambiguous nouns followed by a target word which was either related to the dominant or subordinate meaning of a homophone.

Following Swaab et al. our participants performed a lexical decision task in German, in which visually presented targets were preceded by an auditorily presented prime. The primes consisted of neutral carrier sentences (see Table 1) and ended in a noun which was either homophonous or not. All auditory tokens were elicited in a pre-experiment. The carrier sentences were chosen to indicate the relative length of the homophone. Targets were preceded by either concordant or discordant homophone tokens as primes. Additionally there were unrelated primes and trials consisting of unambiguous primes followed by pseudoword targets.

Table 1: Example of auditory primes and matching with targets:

Cond.	Auditory Prime	Visual Target	Relation & reading type
1	The next word is string (Saite)	Gitarre (guitar)	Concordant, Subordinate reading
2	The next word is string (Saite)	Buch (book)	Discordant, Subordinate Reading
3	The next word is page (Seite)	Buch (book)	Concordant, Dominant Reading
4	The next word is page (Seite)	Gitarre (guitar)	Discordant, Dominant reading

Preliminary results confirmed a stronger priming effect for targets preceded by the dominant reading of a homophone independent of concordance. Targets concordant with the subordinate reading of a homophone showed no priming effect and rather comparable results to unrelated unambiguous primes.



Mean Reaction times based on conditions

In conclusion the results support previous findings reporting a bias towards the dominant homophone reading. There was no indication subtle phonetic features like relative length affecting homophone comprehension.

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Verb particle predictability determines the facilitation effect of pre-verbal material

Stone, Kate[1]; Mertzen, Daniela[1]; Vasishth, Shravan[1]
[1]Potsdam University, Germany

Introduction. One prediction of the expectation-based account of sentence processing is that pre-verbal material sharpens expectation for a verb.[1] On the other hand, it has been suggested that integrating pre-verbal material into the representation of a sentence in working memory may compete for the resources needed to actively maintain a predicted verb.[2] If integrating an intervener does interfere with maintaining a predicted verb, then retrieval of the verb should be slower in the presence of an intervener. An additional, interacting factor should be that high working memory capacity (WMC) readers are more likely than low WMC readers to fully integrate the intervener,[3] increasing the likelihood that it will interfere with maintenance of their verb prediction. These hypotheses were investigated in separable German particle verbs. The benefits of German particle verbs are their high frequency of use in long-distance dependencies and their single lexical entry,[4] which allows control over lexicalisation differences. Predictability was manipulated by increasing the number of licensed particles (more particles = less predictable).

Design. 2x2 with factors predictability (more: A,B; less: C,D) and intervener (none: A,C; adjectival: B,D). 35 items were presented to 60 German native speakers in an eye-tracking (ET) and 60 German native speakers in a self-paced reading (SPR) experiment (critical region ET: "*Nachbarn an",* SPR: "*an*"). All subjects undertook a test of WMC.[5]

A Im sehr vornehmen	Garten **bellte**	er die		Tochter der Nachbarn **an**, doch…
B Im	Garten **bellte**	er die	sehr vornehme	Tochter der Nachbarn **an**, doch…
C Im sehr vornehmen	Garten **schaute**	er die		Tochter der Nachbarn **an**, doch…
D Im	Garten **schaute**	er die	sehr vornehme	Tochter der Nachbarn **an**, doch…
In the very lush	*Garden **barked/looked** he the*		*very elegant*	*daughter of the neighbours **at**, but..*

Results. Log-transformed total fixation times (TFT) in the ET experiment showed a significant interaction such that the intervener slowed down reading at the critical region if the particle was less predictable but sped it up if it was more predictable (β=0.03, SE=0.01, t=2.50). There was weak evidence that this interaction differed according to WMC (β=-0.12, SE=0.07, t=-1.69): More predictable particles were read faster in the presence of the intervener regardless of WMC, however when there was no intervener, lower WMC readers read the less predictable particles faster. The SPR experiment showed no interaction of intervener and predictability on log-transformed reading times at the critical region, only a speed-up for less predictable particles (β=-0.02, SE=0.01, t=-2.25). WMC was not a significant predictor of reading times in SPR, although higher WMC readers showed a trend toward faster reading of less predictable particles (β=-0.07, SE=0.04, t=-1.73).

Conclusions. The intervener only slowed reading times in the less predictable condition of the ET experiment, suggesting that integrating the adjective adversely affected the maintenance of only the less predictable particles. In contrast, more predictable particles appeared to benefit from the intervener in ET, in line with the expectation-based account[1]. WMC was not as strong a predictor as hypothesised, which may be due to the adjectival intervener not posing a heavy enough integration cost.[6] The contrasting pattern of results between ET and SPR raises the question of whether readers with different WMC adopted different strategies between experimental methods.

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Shifting focus within sentences in anaphora resolution

<Katja Suckow and Simone Gerle (Göttingen)>

When an ambiguous anaphora needs to be resolved between sentences, then focused antecedents are preferred over non-focused antecedents. [1.] has systematically demonstrated this for cleft sentences. According to [2.], who established discourse units (DU) as a framework for reference resolution research, sentences can be separated into several DUs making it possible to refer to a focused antecedent within a cleft sentence, given the anaphora is in a separate DU. Nevertheless, the interactions between linguistic cues from separate DUs remain unclear.

We have conducted two sentence completion studies in German to investigate focus effects and their interactions. Experiment 1 (n=36) tested subject-clefts and the different conjunction types (concessive vs. contrastive), along with the types of sentence ("denn"/*since*, "aber"/*but* for coordinate vs. "weil"/*because*, "obwohl"/*although* for subordinate) containing the anaphora, consider the sentence below.

(1) Es war der Beamte, der den Kollegen respektierte, denn / aber / weil / obwohl er ...
It was the civil servant, who respected the colleague, since / but / because / although he…

In the case where the clause with the anaphora indeed constitutes a different DU (as suggested by [2.]), the type of conjunction and the type of clause should shift the focus from NP1 to NP2. Our results show two main effects of sentence type and connector type: more NP1 references were found with coordinate than with subordinate sentences, and more with contrastive rather than concessive connectors. Interestingly, despite both effects, NP1 was still the preferred antecedent, which is in line with [1.]. Experiment 2 (n=36) investigated whether the type of conjunction (concessive-contrastive) interacts with factors from the previous DU, such as cleft-type and verb causality as suggested by [3.].

(2a) Es war der Beamte, der den Kollegen ängstigte / fürchtete, denn / aber er ...
It was the civil servant who scared / feared the colleague since / but he ...
(2b) Es war der Beamte, den der Kollege ängstigte / fürchtete, denn / aber er ...
It was the civil servant who the colleague scared / feared since / but he ...

We found more NP1 references with subject- than with object-clefts, showing that the focus on NP1 had shifted to NP2 under object-cleft conditions. In addition, there was an interaction between verb-causality and connector which depended on the cleft-type (three way interaction). These results provide two major findings for discourse structuring:

1. Focusing the object in a cleft can override NP1 preferences within sentences when the anaphora is in a separate DU (this is in line with [2.]).
2. Verb causality can shift the focus within a sentence, this, however, will interact with the conjunction type from another DU (this is in line with [3.]).

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SES Differences in the Structure of Child-directed Speech

Shira Tal & Inbal Arnon (The Hebrew University of Jerusalem)

One of the key findings in the literature on language acquisition is that socio-economic status (SES) impacts the input children receive: children from higher SES generally receive more input and higher-quality input than children from lower SES, a pattern that has cascading effects on language development [1-3]. To date, most of the work on SES-related differences in children's input has focused on global measures such as the amount of utterances and words or lexical diversity [1-3]. Here, we ask if SES also impacts the structural organization of children's input. Since child-directed speech (CDS) is characterized by certain structural properties that facilitate language learning (e.g., [4]). These features, which impact the quality of the input, may also vary as a function of SES. One unique feature of CDS is the frequent use of successive sequences with partial self-repetitions (for example, the following sequence is addressed to a two-year-old: *-Egg. -Are you pretending that's an egg? -Egg gone. -That's right. -It's alright. -Can you find the egg?*). These sequences, called *variation sets* (VS) are related to better learning outcomes in both naturalistic and experimental settings. Their proportion in CDS is correlated with the acquisition of verbs and multiword constituents [5,6]. Using variation sets in an artificial language led to enhanced word segmentation in adults [7], and better word learning in two-year-olds [8]. That is, variation sets seem beneficial for language learning. If SES impacts the quality of children's input, as has been found for other linguistic measures, then we should see reduced use of variation sets in lower SES.

To address this question, we conducted a corpus study that compares the proportion of variation sets in higher and lower SES mothers using the Howe corpus [9]. We automatically extracted variation sets, and calculated for each transcribed interaction the proportion of utterances (POU) and proportion of words (POW) that appear inside VS. Consistent with our hypothesis, both POW and POU were higher in the higher SES group [POW: 39% vs. 30% ($\beta = 0.08$, SE = 0.03, $p=0.01$). POU: 33% vs. 26% ($\beta = 0.06$, SE = 0.03, $p=0.03$)]. These findings document the role of variation sets in child-directed speech; show that their use varies as a function of SES; and highlights the need to examine the effect of structural features of CDS, and not only global ones, on the trajectory of language learning.

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A Self-Organizing model of the Bilingual Reading System

Stéphan Tulkens, Dominiek Sandra, Walter Daelemans
CLiPS, University of Antwerp; name.lastname@uantwerpen.be

We present a model of bilingual word reading, the Global Space (GS) model, which is based on Self-Organizing Maps (SOMs) (Kohonen, 1989). The main idea behind GS is that many of the observed effects in bilingual and monolingual word reading are the result of ambiguities associated with translating orthographic strings into phonological and semantic forms. We utilize Dynamic Systems Theory, in which the reading of words is viewed as convergence towards an attractor, and ambiguity is the result of the interplay of the forces of multiple attractors. Additionally, this attractor-based account allows for co-activation of words that are related to the string currently being read (Farrar, 2001; e.g., prime 'sofa' causes mispronunciation of target 'touch' via activation of 'couch').

GS is trained by presenting all the phonological and orthographic information associated with a word to a single SOM, which attempts to learn both of these aspects at the same time. Currently, we train the SOM using a corpus of 10,000 tokens, which was sampled from 104 types based on their frequency. The types were chosen for intra- and interlingual similarity, e.g. their orthographic and phonological overlap. All forms (55 Dutch, 54 English, 1 non-cognate identical word) were extracted from CELEX.

During testing, only the orthographic form of a word is displayed to GS, which causes activation on the map. This activation is then fed back into the map as input in subsequent timesteps, leading to co-activation, as seen in Figure 1. We observe competition between orthographic and phonological organization; e.g. the two pronunciations of “lead” are close to each other and co-activate, but the Dutch word “biet” is close to its homophone “beat”. This also shows that GS spontaneously learns crosslingual and interlingual associations, using the same learning mechanisms. Furthermore, words containing language-specific orthography and phonology, e.g. the Dutch ‘ie’ in ‘nies’, are grouped on the map.

An advantage of GS is that orthographic and phonological components of the space remain addressable separately, which may serve to explain task-specific accounts without resorting to separate downstream components. For example, a task which requires a subject to identify words based on orthography would address the orthographic subspace, leading to different distances and patterns of performance.

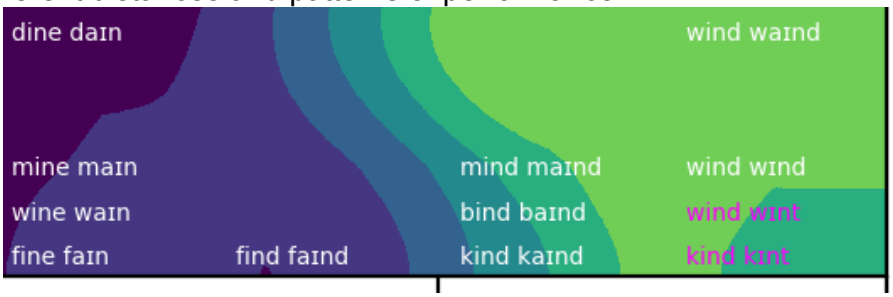


Figure 1: Spreading activation in part of the lexicon when presented with the orthographic form WIND. Lighter colors mean more activation. Dutch words are colored pink.

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L1-modulated sensitivity to aspectual mismatches in L2 English: an ERP study

Norbert Vanek, University of York
Leah Roberts, University of York

Aspect (different ways of viewing a situation, e.g., the completed action of 'entered' in *The polar bear entered the igloo* vs. the ongoing *The polar bear was entering the igloo*) is notoriously difficult for language learners to acquire, and the extent to which a learner's first language influences their ability to learn such grammatical contrasts is not fully clear (Roberts & Liszka, 2013). This study explores what the neurophysiological activity of the brain can tell us about how L2 users and native speakers understand such aspectual differences online and offline, by investigating how they process matching vs. mismatching aspectual cues during sentence comprehension. Of particular interest was the potential influence of the learners' L1s, and to this end we compared proficiency-matched advanced users of English (N=20 per group) with L1 Russian (grammaticalised aspect), and L1 German (no grammatical aspect). A group of 20 English native controls also took part.

In the first task, EEG recordings were taken while participants read sentence pairs involving two event types (80 activities and 80 accomplishments), with one lexical and one grammatical aspect marker per sentence (examples below). Critical sentences contained matching (a, c) or mismatching (b, d) aspect markers. In the second task, each participant provided acceptability judgments of the same sentences in an offline condition (on a 5-point scale). Differences were expected between the two event types in the online condition, with participants from L1-aspect languages showing greater sensitivity for mismatches in activities than in accomplishments (Yap et al., 2009).

Despite both learner groups performing in the same way as the native speakers in the offline judgment task, there was an L1 influence in evidence in the online data. Sentences with mismatched aspectual operators elicited a significantly more robust N400 over the central electrodes in the Russian group. A match-mismatch effect (stronger in activity-type events) was also observed in the English group, but not in the German group. The different pattern of results observed for the off- vs. online tasks suggests that important crosslinguistic differences arise in how rapidly L2 learners activate knowledge about aspectual information. They bring novel support for the view that online processing in the L2 varies as a function of crosslinguistic structural similarity (Alemán Bañón et al., 2014), which also extends to grammatical aspect marking.

Example stimuli

a) ACCOM_MATCH: David **was emptying** the aquarium **for ages** without any help.
b) ACCOM_MISMATCH: David **was emptying** the aquarium **instantly** without any help.
c) ACTIV_MATCH: Charlotte **was singing** popular songs **the whole time** in the shower.
d) ACTIV_MISMATCH: Charlotte **was singing** popular songs **suddenly** in the shower.

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Syntax is the Key to Memorizing Long Sentences: The Role of Brain Oscillations

Benedict Vassileiou, Lars Meyer, Caroline Beese, & Angela D. Friederici
Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany

Sentence comprehension requires the encoding of sentences into working memory. Despite the functional significance of neural oscillations for language comprehension, the neural oscillatory dynamics of sentence encoding are only sparsely understood. While alpha– and beta-band oscillations have been reported both for verbal encoding outside the sentence-processing domain (Hanslmayr, Spitzer, & Bauml, 2009) and for sentence processing (Lewis, Schoffelen, Schriefers, & Bastiaansen, 2016), it is unclear to what extent these frequency bands subserve general verbal processes or processes specific to sentence comprehension. In the present study, we first hypothesized that alpha– and beta-band power changes are associated with successful sentence encoding. We employed a subsequent memory paradigm (e.g., Paller & Wagner, 2002), contrasting oscillatory power changes during the encoding of successfully-remembered versus later-forgotten sentences. We measured the scalp electroencephalogram of 24 healthy German-speaking young adults during the encoding of sentences, each consisting of two clauses and 17 words in total. Subjects' encoding success was assessed via a subsequent, naturalistic retrieval task. Sensor-level time–frequency analysis showed that successful sentence encoding was associated with alpha– and beta-power desynchronizations that were source-localized to dorsal left-hemispheric language areas, as well as bilateral frontal regions, respectively. As encoding of long sentences necessitates the formation of a syntactic structure for memorization, we post-hoc hypothesized that the syntactic structure of the to-be-encoded sentences could help in dissociating the functional role of the two affected frequency bands. Strikingly, single-trial analysis of source-power time courses revealed that sentence encoding and comprehension were successful only when alpha-power desynchronization tracked the sentences' gross syntactic structure. The time course of beta-power desynchronization did not relate to syntactic structure; in addition, our beta-power cortical generators have been related to mentalization of action roles. Thus, our beta-band effect likely reflects domain-general processes for the construction of sentence-level meaning (Kandylaki et al., 2016; Weiss et al., 2005). Our findings suggest that memory encoding of long sentences requires a structural representation to keep processing within capacity limits, the formation of which is subserved by alpha-band power desynchronization. Alpha– and beta-power desynchronizations are fingerprints of dissociable sentence-level language-specific syntactic and domain-general semantic processes, respectively.

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Digging-in effects in Italian relative clauses

Sandra Villata (University of Geneva), Ludovico Franco (University Nova de Lisboa),
Paolo Lorusso (University of Florence / CRIL University of Salento)

Italian relative clauses (RCs) are ambiguous between subject and object RCs since Italian permits post-verbal subjects. In the absence of disambiguating cues, the parser automatically engages in a subject RC analysis. Two grammatical cues have been shown to trigger an object RC reanalysis: i) word order (OSV), and ii) number agreement (e.g., $O_{\text{-SG}}$ $V_{\text{-PL}}$ $S_{\text{-PL}}$) (e.g., Arosio et al. 2009). However, both cues are available at early processing stages, namely in the relative clause. Here we tested the effectiveness of a late agreement cue appearing after the relative clause in triggering an object RC reanalysis, allowing us to disentangle predictions from two prominent accounts of sentence processing: the cue-based memory model (Lewis & Vasishth 2005) and the self-organized parsing model (Tabor & Hutchins 2004). The cue-based memory model assumes that comprehenders exploit cues for structure building operations, such as retrieval and reanalysis, when these features are realized on the verb, regardless of the processing stage at which these cues are made available. The self-organized parsing model assumes that late cues are less effective than early cues in structure building operations, because the more stable an analysis becomes, the harder to undo (*digging-in effect*). Predictions are straightforward: the cue-based memory model predicts that late agreement cues will successfully trigger object reanalysis to the extent to which they are realised on the verb, while the self-organized parsing model predicts that late cues will be scarcely effective in triggering reanalysis. In a self-paced reading task, we tested 34 Italian speakers in subject-past participle gender agreement in RCs, since gender, unlike number, can be manipulated on the past participle following the relative clause. The two noun phrases (NPs) always mismatch in gender and the past participle agrees either with the pre-verbal NP (subject RC analysis) or the post-verbal NP (object RC analysis) (*e.g., The mayor-M / that / consults / the journalist-F / before / being / **heard-M/F** / by everyone / lives / in Paris*). We generated 32 sets of sentences followed by a comprehension question targeting thematic roles attribution. Residual log reading times (RTs) for correct and incorrect trials and accuracy proportions were analyzed with (generalized) linear mixed-effects models.

Results. RTs at the region following the past participle were slower when the past participle agrees with the post-verbal NP (object condition, M=682ms) than when it agrees with the pre-verbal NP (subject condition, M=619ms) (p=.013). Accuracy rates were higher in the subject (M=0.83) than in the object condition (M=0.2) (p<.001). **Discussion.** Results showed that participants were both slower at the spillover region and less accurate in answering the comprehension question in the object condition. Participants failed to access the object analysis 80% of the time. Crucially, the percentage of correct responses in the object condition did not differ from the percentage of incorrect responses in the subject condition, thus providing no evidence that participants ever truly accessed the object analysis. This stands in contrast with studies showing successful reanalysis in adults when disambiguating agreement cues comes early in the sentence (Arosio et al. 2009; Guasti et al. 2012). Our results thus challenge models granting no role to when structure building cues become available during structure building, such as the cue-based model, and are rather in line with a self-organized parsing model.

Attentional engagement versus effort in lexical access

Anita Wagner [a, b] & Deniz Başkent [a,b]

[a] *University of Groningen, University Medical Centre Groningen, Department of Otorhinolaryngology/Head and Neck Surgery Groningen, The Netherlands*

[b] *Graduate School of Medical Sciences, School of Behavioral and Cognitive Neuroscience, University of Groningen*

The initial stages of speech processing are traditionally seen as automatic, but more recent research suggests that speech comprehension is an active process that engages attention [2,3]. The lack of automaticity becomes only apparent when speech comprehension becomes effortful, as in adverse conditions, such as speech perception by hearing impaired listeners or communication in noisy surroundings. Attention and effort are often used interchangeably, but it is unclear whether effort is the consequence of increased attention, or whether increased effort modulates the allocation of attention. This paper investigates the role of attention versus effort in speech perception on a set of eyetracking experiments that combine recordings of gaze fixations with pupillometry.

Listeners' allocation of attention was studied during the time-course of the automatic process of lexical competition. Lexical competition is the process during which listeners subconsciously consider several lexical entries that overlap with the auditory input to be the word intended by the speaker. This process is modulated by listeners' expectations about upcoming words based on the preceding sentential information [1].This reduction in lexical competition due to integration of semantic information was utilized to study how reduced lexical competition among phonologically overlapping words affects effort versus attention, as captured by listeners' pupil dilation. Normal hearing (NH) listeners were presented with sentences with or without a semantically constraining verb (e.g., crawl) preceding the target (baby), and their ocular responses were recorded to four pictures, including the target, a phonological (bay) competitor and a semantic (worm) and an unrelated distractor. In addition, adverse conditions were simulated by comparing listeners' processing of natural speech to the processing of spectrally degraded, time-compressed speech, and speech in the background of noise or competing talkers.

The time-course of gaze fixations show that early integration of semantic information reduces the competition between phonologically similar words for natural, time-compressed speech, but not for spectrally degraded speech or speech masked by noise or competing talkers. Complementary to this, the pupil dilation data shows a fast and quickly resolved increase in pupil dilation as a function of lexical competition for natural and time-compressed speech. This is not the case for degraded or masked speech, where pupil dilation that is time-locked to lexical competition is significantly reduced. In adverse conditions, which include masking or reduction of information we find increased pupil dilation as a function of listening to the speech. We interpret this as evidence for short and targeted increase of attentional involvement during lexical access in natural and time-compressed speech, and as an arrest of these attentional mechanisms when processing becomes effortful for spectrally degraded and masked speech.

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Language-induced event schemas in memory for event duration

Yaqi Wang & Silvia Gennari
The University of York

Prior research on the influence of language on episodic memory has shown that post-encoding linguistic descriptions of the original observed event may alter what observers subsequently recall [1]. Yet current event perception and memory theories [2] suggest that event schemas stored in semantic memory may influence how events are initially encoded and, due to this encoding, how they are subsequently remembered. Here, we investigate this possibility and specifically ask whether language-induced event schemas can change how an event is initially encoded and remembered.

To this end, we developed 21 cartoon-like animations of varying durations using web questionnaires. Each animation could be described with two phrases, each implying either **fast** or **slow** motion. E.g., Figure 1 (dotted line indicates motion path) can be described as *an ambulance* or *a bus going to the hospital.* In the studies below, each animation was paired with either a fast or slow phrase at encoding for a subsequent memory test (pair-associate learning). If the phrase-induced schema modulates how the same physical animation is encoded, then, the animation should be recollected as shorter when the phrase implied fast motion rather than slower motion.

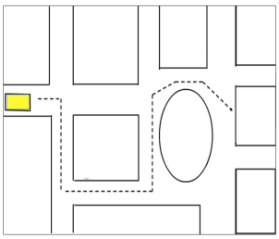


Figure 1: Example animation

In Study 1, participants saw the stimuli at encoding only once (random order). After encoding, the phrases were used to cue the associated animation. Participants were first asked to mentally reproduce the associated animations in their original time course (duration reproduction), and then verbally recall them. Reproduced duration (RD) and verbal recall were measured. Results indicated that RDs were indeed shorter when the phrase implied fast motion compared to slow motion ($p < .05$). An event segmentation task [2] conducted by separate naïve observers also showed significant differences, and the number of segments identified in each animation significantly predicted RDs. This demonstrates a language-induced schema effect in event encoding and recollection.

Study 2 then asked whether deeper encoding modulates this effect. If the event schema is more strongly associated with the animation, lager effects should be expected. Alternatively, deeper, more detailed knowledge of the animation may lead to more accurate RDs (no difference). Study 2 was like Study 1 except that each animation-phrase pair was presented three times (3 cycles through the stimulus set). Results indicated that the RDs did not differ significantly for slow and fast phrases, although segmentation significantly predicted RDs as before. Verbal recall data also indicated that in Study 2 participants remembered more details about the animations than in Study 1.

Taken together, the results suggest that language-induced schemas influence event duration recollection only when fewer details were remembered and the event was weakly encoded, i.e., observed once (as in many cases of witness testimony). Thus, the phrase modulated how events were mentally reproduced at recollection. However, when the events were deeply encoded and more details are remembered, language plays a lesser role in helping event recollection.

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Modulating Conceptual (but not Perceptual) Competition in the Visual World

Glenn P. Williams (Abertay University: g.williams@abertay.ac.uk),
Anuenue Baker-Kukona (De Montfort University), & Yuki Kamide (University of Dundee)

Current theories of conceptual representations (e.g. Yee & Thompson-Schill, 2016) argue against a strict division between episodic and semantic memory: concepts are indivisible from the contexts and/or tasks in which they appear, and the recent or ongoing context determines which dimensions of a concept are retrieved. For example, lexical decision and reading-aloud tasks (which both focus attention on the visual modality) are facilitated for visually-experienced words (e.g. *cloudy*), and reading aloud (also auditory) is facilitated for auditory words (e.g. *noisy*) (Connell & Lynott, 2014).

Given Tulving's (1972) proposal that episodic memory is tied to discrete spatiotemporal episodes, in a previous experiment we predicted that spatiotemporal factors influence conceptual retrieval and competition among related concepts. Building on Huettig and Altmann (2005), in that experiment, participants (N=60) viewed quadrants with a target (LOCK), a semantic competitor (KEY), and two unrelated distractors (BALL, MELON), and we tracked their eye-movements while they heard sentences describing the LOCK and KEY in the same or separate locations (e.g. 'The lock and the key are in the cafeteria. The ball and the melon are in the parlour' vs. 'The lock and the melon are in the cafeteria. The ball and the key are in the parlour.', and with order of mention counterbalanced within items). Following re-mention of the LOCK ('It seems that the lock is very old.'), we found a larger proportion of fixations on the competitor than the average of the two distractors only in the 'same' (but not in the 'separate') condition. This suggests that the spatiotemporal location described by the discourse acts to increase/decrease the conceptual overlap between the LOCK and KEY (e.g. Huettig & Altmann, 2005).

In the current experiment, we tested discourse effects on object competition based on visual similarity (e.g. BAT & CIGARETTE). We predicted that the discourse-mediation effect in our previous experiment might be due to some commonalities between semantic and discourse domains. However, visual properties of objects might not interact with discourse properties, especially in a setting wherein visual features are explicitly depicted and made salient (e.g., visual-world). Here, participants (N=60) again viewed quadrants containing four objects while hearing sentences describing the BAT and CIGARETTE in the same/separate locations while we tracked their eye-movements. Following re-mention of the BAT, we found a larger proportion of fixations on the competitor than the average of the two distractors (MELON and SHIRT; visual competition effect) in both 'same' and 'separate' conditions, with no difference in the proportion of fixations on any of the objects between conditions. Together, we find that discourse context modulates conceptual, but not perceptual competition in the visual world. Thus, while spatiotemporal discourse context can influence competition, this effect is modulated by the task context, consistent with strongly context-oriented perspectives.

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Eyes movements during visual speech in deaf and hearing children

Elizabeth Worster[1], Hannah Pimperton[1] and Mairéad MacSweeney[1,2]
[1] Institute of Cognitive Neuroscience, University College London
[2] Deafness, Cognition and Language Research Centre, University College London

Although speech is generally considered within the auditory domain only, visual information is very important for guiding speech perception, especially for children who are born deaf. Deaf children and adults have been shown consistently to have poorer average reading skills than their hearing peers (diFrancesca, 1972; Conrad, 1979; Wauters, van Bon & Tellings, 2006; Qi & Mitchell, 2011). Speechreading (lipreading) correlates positively with reading in deaf children and adults (e.g. Mohammed et al., 2006) and is a positive longitudinal predictor of later reading outcomes (Kyle & Harris, 2010). However, little is known about the strategies deaf children use when watching visual speech. Studies with hearing adults show they look more at the mouth during audiovisual speech as the noise level increases (e.g.Vatikiotis-Bateson et al., 1998), suggesting that visual information from the mouth aids speech perception in noisy environments. In the current study we asked whether time spent looking at the mouth relates to speechreading performance in both deaf and hearing children.

We collected eyetracking data from 33 deaf children and 59 hearing children (age range: 5-8 years) during a speechreading task. The children watched videos of silently spoken sentences and repeated, in English or British Sign Language, what the speaker said. They were awarded one point for each lexical item correctly identified with a maximum score of 62.

The proportion of time spent looking at the mouth during speech positively predicted the number of words correctly repeated. Additionally, both deaf and hearing children showed a common pattern which involved watching the mouth during speech but watching the eyes when the model was not speaking. The extent to which the children used this communicative 'social tuning' pattern positively predicted their speechreading performance, with the deaf children showing a stronger relationship than the hearing children. These data suggest that deaf children with a good understanding of turn-taking also have good speechreading skills.

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Evidence for the Prosodic Structure of Multiword Utterances in L2 Speech

Hilary Wynne[1], Linda Wheeldon[2], Aditi Lahiri[1]
[1]University of Oxford, [2]UiA University of Agder

Multiword utterances regularly exhibit word boundaries that are not necessarily sacrosanct. For example, in the English slogan *Drinka pinta milka day*, the linguistic units correspond not to the syntactic representation of the utterance (*Drink a pint of milk a day*) but to how it sounds in regular, connected speech, i.e. its prosodic structure. This mismatch in prosodic and lexical structure points to a process in speech production where features of connected speech must be prepared: that is, where *drink a* becomes *drinka*: the phonological encoding process. There is increased evidence that prosodic rather than lexical structure governs phonological encoding processes in speech production. However little is known about the planning of this process in non-native (L2) speakers. The questions we ask here are thus: how are multiword structures prepared in L2 speech, and how does the native (L1) language interfere with this process?

A number of psycholinguistic tasks have revealed that English compounds, which contain two (or more) lexical items, are regularly treated as single prosodic units by L1 speakers (Wheeldon & Lahiri, 2002; Janssen et al., 2008; Jacobs & Dell, 2014). Following this, we hypothesise that clitics attach to compounds in the same way as they attach to monomorphemic words. To investigate this, we conducted four psycholinguistic naming tasks using English noun-noun compounds, adjective-noun phrases, disyllabic initial-stressed words, and monosyllabic words (cf. Table 1). All target items were presented in the plural (e.g. *dishcloths*) and the auditory prompts (e.g. *What are dry?)* were as to encourage reduction and attachment of the auxiliary *are* in responses: e.g. *dishcloths are dry*.

Table 1: Conditions

Comp	AdjN	'σ σ	σ
dishcloths	*drab cloths*	*donkeys*	*ducks*

We know from previous speech production research (Wheeldon & Lahiri, 1997) that responses are affected by planning time. Therefore, Experiments 1 and 2 presented the stimuli in a delayed paradigm to L1 and L2 speakers, and Experiments 3 and 4 presented the stimuli in an online naming paradigm to both speaker groups. The speaker groups contained, respectively, 50 native British English speakers and 50 native Bengali speakers fluent in English.

In all four experiments, we found evidence that both L1 and L2 speakers of English treated compounds as single prosodic units. Adjective-noun phrases, conversely, were overwhelmingly treated as two separate prosodic units. While latencies for the delayed tasks reflected the total number of prosodic units in the target sentence, latencies for the online tasks only reflected the complexity of the *first* prosodic unit. Response latencies in the online tasks also indicated that the clitic *are* attached leftwards to the entire compound unit (e.g. [dishcloths]are]), but only to the noun in the phrasal condition (e.g. *dish* [cloths]are]). This was the case for both groups of speakers.

While overall longer naming latencies reflected interference from the speakers' L1, these non-native speakers were able to access and build the correct L2 prosodic frames for both multi-word utterances in English. Our findings lend support to the claim that prosodic structure dictates the arrangement of prosodic frames during phonological encoding in speech production in both native and non-native English speakers. These results are discussed further in relation to issues of fluency and planning in L2 speakers.

Automatic Evaluation of Simultaneous L2 Oral Reproduction Tasks with a Deep Learning-Based Algorithm

Yutaka Yamauchi[1], Nobuaki Minematsu[2], Kayoko Ito[3], Megumi Nishikawa[4], Kay Husky[5], Aki Kunikoshi[6]

[1,5]Tokyo International University, [2]University of Tokyo, [3]Kyoto University, [4]Tokai University, [6]University of Groningen

This study attempts to clarify how a deep learning-based algorithm can increase the measurement accuracy of automatic evaluation of simultaneous L2 oral reproduction tasks.

In simultaneous oral reproduction tasks learners are requested to listen to and comprehend model utterances of target passages and simultaneously reproduce them orally. This task is expected to enhance not only listening comprehension and speaking skills, but also promote learners' language processing to become more accelerated and automatized. As the model utterances are spoken at a faster rate, learners have to speed up in decoding auditory input information, comprehending the message and orally reproducing what they have heard. As a result, their language processing is thought to be changed from controlled into automatized.

Although this task seems to be prominent in developing L2 oral skills and automatizing L2 language processing, a serious problem lies in how to assess this performance objectively. In many cases the evaluator has to listen to the recorded reproduced speech repeatedly while checking the script and calculate the ratio of the number of syllables or words correctly reproduced to the total number of syllables or words in the target passage. This procedure is too time- and energy-consuming for teachers to implement this task in daily classroom activities. To reduce the rater's burden, an automatic evaluation system was developed by our research group using a probabilistic acoustic model named HMM (Hidden Markov Model). In this system a computer can automatically compare the learner's orally reproduced speech and the model speech using an acoustic model stored in the PC at a phoneme level. This system can analyze and evaluate reproduced speech and give scored feedback to the learner.

As one of the latest technologies in speech science a deep learning-based algorithm is expected to enable artificial intelligence (AI) to implement what has been impossible for it to date (Rasipuram, Cernak, Nanchen & Magimai-Doss, 2015). This study tried to develop a new automatic evaluation system employing a deep learning-based algorithm and clarify the effectiveness of the system in comparison with the traditional evaluation system and manual assessment.

One hundred twenty learners at different English proficiency levels were requested to orally reproduce the target passages. Their recorded reproduced speeches were assessed in three ways: automatic evaluation based on a traditional acoustic model algorithm, automatic assessment based on a new algorithm using a posterior probability support vector, and manual assessment by veteran language instructors with the five-point Likert scale focusing on pronunciation, prosody and accessibility of one's mental lexicon. The experimental results showed that the correlation (r=.82) between automatic scores obtained from the new algorithm and manual scores was found to significantly outperform the correlation (r=.49) between automatic scores computed from the traditional algorithm and manual scores, and thus the improvement of measurement accuracy was confirmed.

Direct Speech Quotations Promote Low Relative-Clause Attachment in Silent Reading of English

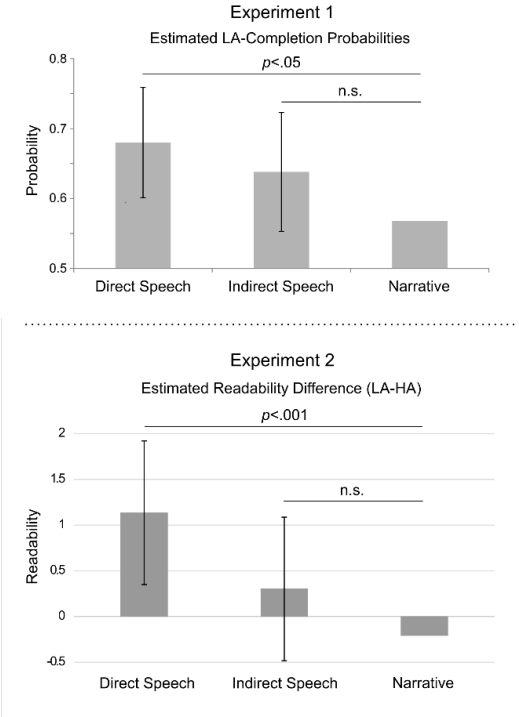
Bo Yao[1], Christoph Scheepers[2]
1 Division of Neuroscience and Experimental Psychology, University of Manchester, UK
2 Institute of Neuroscience and Psychology, University of Glasgow, UK

The implicit prosody hypothesis proposes that silent reading coincides with a default, implicit form of prosody which may bias syntactic attachment decisions in structurally ambiguous sentences [1]. Recent research demonstrated that a more vivid form of implicit prosody is mentally simulated during silent reading of direct speech quotations (e.g., *Mary said, "This dress is beautiful"*), with neural and behavioural consequences [2,3]. Here, we explored the relation between *default* implicit prosody and *simulated* implicit prosody in the context of relative-clause (RC) attachment in English. In two experiments, we examined attachment preference for RC structures that were embedded in direct speech, indirect speech or narrative sentences, respectively.

In Experiment 1 (N=54), participants completed sentence fragments like *I really liked the bells of the church that…*. Using binary logistic mixed models, we found that target sentence fragments elicited a significantly higher proportion of low-attachment completions (to "the church") when they were embedded in direct speech quotations than in plain narrative contexts (b=0.48, p=.018); the indirect speech and narrative conditions did not differ reliably from one another (b=0.29, p=.148).

In Experiment 2 (N=24), participants rated the "readability" of complete sentences with low-attached or high-attached RCs (e.g., *I really liked the bells of the church that* {*was tall* / *were ringing*}, again embedded in either direct speech, indirect speech or narrative contexts. Mixed modelling revealed that, relative to the narrative condition, the readability difference between low vs. high-attachment sentences was significantly larger (+1.34 scale points ± .40 *SE*, p<.001) in the direct speech condition, but only numerically larger (+.51 scale points ± .40 *SE*, p=.204) in the indirect speech condition.

These results are a first-time demonstration of a reliably more pronounced low-attachment preference in English RC structures that are embedded in direct speech quotations, suggesting a shared cognitive basis between default implicit prosody and simulated implicit prosody during silent reading.



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Visuo-semantic size congruency effects in concrete and abstract word recognition

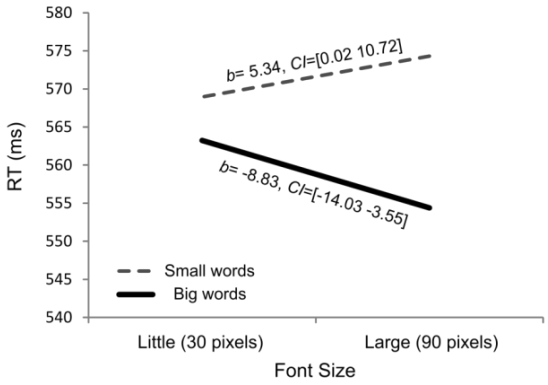
Bo Yao[1], Sara C. Sereno[2]
1 Division of Neuroscience and Experimental Psychology, University of Manchester, UK
2 Institute of Neuroscience and Psychology, University of Glasgow, UK

Previous research has demonstrated a processing advantage for semantically ''big'' versus ''small'' words having either concrete (e.g., *jungle* vs. *needle*) or abstract (e.g., *trust* vs. *trace*) meanings [1,2]. This bigger-is-faster effect has been attributed to differential lexical processing of "size" based on visuo-spatial sensory features associated with concrete words and on emotional qualities associated with abstract words [2].

The current research investigated the visuo-spatial grounding of size in concrete and abstract words by examining the interaction of visual font size and word semantic size in a lexical decision task (notably, without explicit judgments of font or semantic size). Fifty participants were tested on 220 target words in a 2 (Concreteness: Concrete, Abstract) × 2 (Semantic Size: Big, Small) × 2 (Font Size: Large, Little) within-participants design.

Using maximal linear mixed models, we found that concrete words were processed faster than abstract words [b=-16.48, t=-4.64, p<.001], and that semantically big words were recognized faster than semantically small words [b=-12.83, t=4.05, p<.001]. There was also a Semantic Size × Font Size interaction [b=-14.18, t=-4.04, p<.001], indicating a visuo-semantic size congruency effect (**Figure 1**). No other effects were significant.

Figure 1: Semantic × Font Size interaction



The findings demonstrated facilitated processing when the semantic size and visual font size were congruent, for both concrete and abstract words. The latter is surprising because, unlike concrete objects, abstract concepts are not directly linked to our sensory-motor experiences of the physical world. The size congruency effect in abstract words may be metaphorical in nature [3], or mediated by font size-emotion generalizations [4].

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The ambiguity of natural gender in coreference dependency formation

Lauren Ackerman, Nick Riches, Joel Wallenberg (Newcastle University)
lauren.ackerman@ncl.ac.uk

The Gender Mismatch Effect (GMME) provides valuable insight into the parser's behavior during long-distance dependency formation and structure building, since the parser actively and eagerly seeks the antecedent of the anaphor that triggers the dependency [1,2,3, a.o.]. However, gender manipulations are often used without considering how the antecedent's gender (particularly for personal names) is encoded or what qualifies as 'mismatched'. For example in (1), the gender of the name is ambiguous in isolation. Therefore, this study investigates how the mental representation of gender influences the parser's behavior during coreference dependency formation.

(1) While he drives to work, Sam listens to the radio.

A GMME occurs when two structural positions that could corefer are linked during Active Search, e.g. the positions in (1) of "he" and "Sam" (see: [1, references therein]). If the parser finds that the items' genders mismatch, it must revise that link, thereby causing a processing slowdown. Probing the parser's behavior in this way relies on gender being a property that *can* (mis)match. Determining the gender of the referent of a name in English relies on knowledge of societal conventions, but conventional gender of names/anaphora can be ambiguous and 'gender' may include categories beyond a male/female binary [4,5].

To evaluate the categorical/gradient potential for name-anaphor pairs, 72 L1 English speakers were recruited through MTurk and were asked to rate sentences like (2) on a 7-point scale of naturalness. The gender of the anaphor and name were manipulated in a 3×3 design (Anaphor: her-, him-, themself; Name: male, female, ambiguous).

(2) As a young toddler, Morgan dressed herself every morning without help.

The parser might underspecify the gender of an ambiguous name, in which case we predict ambiguous names paired with him-/herself to be rated as acceptable as matching pairs, since no gender features will mismatch. Alternatively, readers could probabilistically select a binary gender for an ambiguous name, thus would be surprised when the selected gender is incongruent with the anaphor, even though it could still recover quickly. In this case, we would predict ambiguous names paired with him-/herself to be rated lower than unambiguous names paired with the 'matching' anaphor. Our treatment of 'themself' pairs is exploratory, but examining a gender-neutral option could demonstrate if ambiguous names are represented as having underspecified gender [Cf., 6].

Unsurprisingly, matched anaphor-name pairs were rated highly ($\bar{x}$=6.5, sd=.85) and mismatched pairs were rated lower ($\bar{x}$=4.5, sd=2.2). These significantly differed from each other ($p<0.01$). Ambiguous names paired with him-/herself were also rated highly ($\bar{x}$=6.3, sd=1.1), but still significantly lower than matched pairs ($p<0.01$). Pairs containing 'themself' were rated lowest of all ($\bar{x}$=3.7, sd=2.1, $p<0.01$), and ambiguous name-themself pairs were not rated higher than other name-themself pairs. This is consistent with the findings of [6] and also suggests that ambiguous names could be gendered probabilistically. This study is a first step toward understanding how natural genders of names and anaphora are processed during language processing, which has direct implications for coreference dependency formation. It also provides a benchmark for an ongoing reading time study.

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The Effect of Printed Word Attributes on Arabic Reading

Ahmed Alhussein, Robert Davies and Gert Westermann, Lancaster University

Arabic is a Semitic language that is read and written from right to left. Short vowels and certain features are written as diacritics. Printed Arabic texts usually contain no diacritics, therefore many groups of words appear identical in print (homographs). The high level of homography is believed to present difficulties for the skilled reader. However, very few studies have presented words without diacritics, hence their findings may not reveal much about natural Arabic cognitive reading processes. Critically, no evidence exists on what readers know about the different words that can be associated with each homograph. We report findings from four studies. (1.) To find out what words people think of, given homographic letter strings, we presented lists of 99 or 98 unvowellized words (without diacritics), and asked participants to produce the one or more word forms (with diacritics) evoked by each target. In total, we recorded responses to 1474 Arabic words from 445 adult speakers of Arabic. We calculated the number of different forms associated with each unvowellized word, and the percentage agreement. (2.) We collected subjective Age-of-Acquisition ratings for the agreed form of each unvowellized word. (3.) We asked 38 participants to produce pronunciation responses to 1474 words. And (4.) we asked 40 participants to produce lexical decisions to 1352 words and 1352 matched non-words. Mixed-effects models showed that orthographic frequency, Age-of-Acquisition and name agreement influenced word naming, while lexical decision was not affected by name agreement. The implications of our findings for theoretical accounts of reading processes will be discussed.

Syntactic-Adaptation vs Task-Adaptation: The Case of Object Relative Clauses

Caroline Andrews, Adrian Staub & Brian Dillon (UMass Amherst)

Recent work has investigated whether comprehenders adapt to their syntactic environment, allowing structures that are rare and difficult in normal processing to be ameliorated in the context of an experiment [1,2]. [3] found that the processing difficulty associated with an Object Relative Clause(ORC) decreased after repeated exposure to ORCs. Similar findings for the Main V/RRC ambiguity in [1] further showed that the amount of decrease tracked the number of critical tokens participants had seen. [1] attributed this effect to increased expectation for the dispreferred structure (ORC or RRC) within an experiment; this leads to lower surprisal values [4] and thus lower processing costs.

A limitation of [1] and [3] is that the critical measures come from self-paced reading (SPR). SPR is less practiced than normal reading, requires a conscious decision at each button press, and is potentially prone to task strategies, which may vary across trials and participants. In effect, participants in SPR are learning the task during the experiment, making separation of task adaptation from syntactic adaption difficult. Eye-tracking, however, leverages a skill which is pre-practiced, leaving less concern that task adaptation will intrude into processing effects. The increased temporal sensitivity of eye-tracking also allows more precise reasoning about the mechanisms behind adaptation than SPR.

The present analysis investigated syntactic adaptation through exposure by combining two eye-tracking experiments ($N_{1\&2}$ = 119) from [5] for increased power. Both experiments compared ORCs and SRCs using the same sentences based on (1).

(1) *The chef that [the waiter distracted __ /__distracted the waiter] poured the flour...*

If [3] were replicated, the syntactic adaptation account of [1] predicts an interaction of (trial) ORDERxRCTYPE on the subject NP region: reading times (RTs) for the subject NP inside an ORC should speed-up as participants encounter more instances of ORCs, but RTs for the same region in SRCs should either remain constant across all time points or speed-up more modestly as comprehenders generally read more quickly across the experiment.

Consistent with [5], the penalty for ORCs manifested at the noun phrase (Rel NP) in first pass and go-past (*LMER FP: t=2.04; GP: t=8.68*) as a main effect of RCTYPE. In addition, there was a speed-up at Rel NP for ORDER in go-past RTs (*t=-3.01*). However, the ORDERxRCTYPE interaction was not significant in any measure at Rel NP (*FP: t=0.52; GP: t=-1.2;* Figure 1).

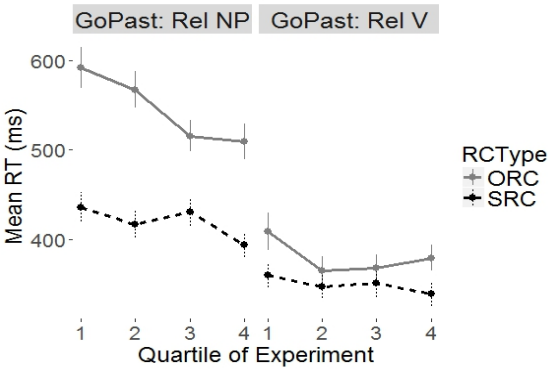


Figure 1: Go-past times across trial order within condition at the Rel NP and Rel V regions. Error bars plot standard errors.

Our analysis reveals that trial order did speed reading times on the noun phrase constituent inside the relative clause, but we found no evidence that the magnitude of this order effect differed for ORCs vs SRCs, contra the predictions of an expectation-based account. The failure to find the predicted interaction is notable given the high power of this analysis. Future work should directly compare adaptation in SPR and eyetracking to determine the extent to which task-strategies interact with expectation-based processing.

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Artificial language learning of an optional grammatical marker

Emily Atkinson[1,2], Karen Clothier[1], Christiana Vargas[1]
[1]Johns Hopkins University, [2]University of Michigan

Recent research utilizing the artificial language learning paradigm has identified the biases that underlie adult language learning [1-3]. These studies have found that adult participants are capable of generalizing phonological [1] and syntactic [2-3] rules from variable input. However, variable input does not always indicate production errors; rather, it can indicate that a particular structure is optional. Is it possible for participants to use variable input to learn the meaning of an optional grammatical marker, and how do they use such a marker in their productions? In particular, this study examines the learnability of an optional *wh*-agreement marker, such as the one found in the Austronesian language, Chamorro. In Chamorro, a *wh*-agreement marker optionally appears on the verb when the gap is in the direct object position [4]. Artificial Chamorro (AC) has VSOP word order, like Chamorro, but utilizes English nouns and verbs. Additionally, it includes 3 nonce function words: 1) *zub*, a *wh*-question marker; 2) *po*, a generic preposition; and 3) *ka-*, the optional direct object gap marker. During an initial learning phase, participants (N=48) were shown picture-sentence pairings, which demonstrated 10 declaratives (1a), 10 *yes-no* questions (1b), 40 direct object (DO) gap questions (1c, 20 unmarked), and 20 prepositional object (PO) gap questions (1d).

Comprehension: Participants performed a binary acceptability judgment task on AC sentences (n=38, 22 grammatical). Participants successfully learned the VSOP word order as they identified grammatical sentences significantly above chance (85%, $p<0.001$) and rejected sentences with the wrong word order (68%, $p<0.05$). They also demonstrated knowledge of the meanings of *zub* and *po* by rejecting sentences in which these words were required (*zub*: 77%, $p<0.001$; *po*: 94%, $p<0.001$). For the critical case – DO gap questions – participants accepted questions both with and without the optional marker at equal rates (91% vs. 87%, $p>0.1$). However, they rejected sentences with ungrammatical uses of *ka-* significantly *less* than chance (34%, $p<0.001$). In general, participants were highly willing to accept questions in which *ka-* appeared.

Production: Participants were prompted to produce questions that were appropriate for 20 images (16 DO gap, 4 PO gap). Participants were significantly more successful at producing DO gap questions (79% vs. 50%, $p<0.001$). Unsurprisingly, 63% of the ungrammatical PO gap questions contained the illicit DO gap marker *ka-*. Of the grammatical DO gap questions, only 39% utilized the optional DO gap marker.

These results suggest that participants may not have learned the appropriate meaning of the optional marker. Individual analyses, however, reveal that this is not the case. Though most participants never used the optional marker (n=14) or used it less than a third of the time (n=9), almost a quarter of the participants used *ka-* in 70% or more of their grammatical productions (n=13). Despite completely ambiguous input, many participants generalized the use (or disuse) of the DO gap marker in their productions. Implications of these results for the general learnability of optional grammatical markers and language specific preferences will be discussed.

(1) a. eating Susan cake po fork. ‘Susan was eating the cake with the fork.’
b. eating Susan cake po fork? ‘Was Susan eating the cake with the fork?’
c. zub (ka-)eating Susan __ po fork? ‘What was Susan eating with the fork?’
d. zub eating Susan cake po __? ‘What was Susan eating the cake with?’

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Are neighbourhood density (N) effects influenced by age and/or language background during word recognition?

Nancy Azevedo [1,2], Eva Kehayia [1,2], Ruth Ann Atchley [3]
[1] McGill University, [2] Centre for Interdisciplinary Research in Rehabilitation (CRIR)- Jewish Rehabilitation Hospital, [3] University of Kansas

Processing lexicality is known to be influenced by many factors, including the number of lexical neighbours an item has. In young adults (YAs), neighbourhood density (N) has been found to influence a person's ability to make lexicality judgements [1]. Called the N effect, a large lexical neighbourhood facilitates word access (fast reaction times (RTs) and low error rate) but is inhibitory for pseudowords (slower RTs and higher error rate) in English. Data from a visual lexical decision task investigating changes in how N is processed in healthy aging showed two main findings. 1) While YAs showed the predicted N effect for words and pseudowords, older adults (OAs) showed an N effect for pseudowords only. 2) YAs made significantly more errors to high-N pseudowords than OAs (but not to low-N pseudowords nor to high- or low-N words). While these differences were initially attributed to age differences between the groups, it is possible that they may have been related to differences in language background between the groups. To further investigate whether language background may be influencing the N effect in the lexical decision tasks, we are running the experiment on a group of YAs who have a similar language background to the OAs, i.e. bilingual or multilingual dominant English-speakers.

Methods: Simple lexical decision task probing three stimuli types: words (n=160: 80 nouns and 80 verbs); pseudowords (n=80), each controlled for length and number of lexical neighbours; and nonwords (n=80). Word stimuli had a moderately high frequency of use in English. Words and pseudowords were divided into low versus high neighbourhood density groups. Stimuli with 0 to 2 neighbours comprised the low-N group while stimuli with 5 to 18 neighbours made up the high-N group, nonwords had 0 lexical neighbours.

Participants: While data collection is on-going, to date 21 dominant English-speaking bilingual/multilingual YAs (13F, age 19-28) have participated.

Preliminary Results and Conclusions: Thus far, we observe two main findings: 1) bilingual/multilingual YAs showed an N effect for pseudowords (97 ms inhibition) but no N effect for words (8 ms facilitation). This had previously been found for the OAs but contrasts with results from monolingual YAs. 2) Similarly to monolingual YAs, but in contrast to OAs, bilingual/multilingual YAs made a large number of errors to high-N pseudowords (mean: 19%, 95% CI: 14%-23%). Results suggest a differential effect of age and language background on the N effect, depending on the stimulus type being processed. Results will be discussed in the context of monolingual [2-3] and bilingual/ multilingual [4] models of word recognition.

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Do older adults follow convention when designing referential expressions?

Julie Bannon, Rahaleh Saryazdi, Craig G. Chambers, *University of Toronto*

Although there is a considerable body of research examining how young adults and children design referring expressions for listeners, comparatively little is known about how this ability changes over the adult lifespan. To date, the existing work on this topic has tended to show less efficient patterns of communication in older adults, such as the use of more words and a greater number of conversational turns compared to young adults when identifying traditional tangrams or caricature faces (Bortfeld et al., 2001; Lysander & Horton, 2012). Similarly, older adults in referential communication tasks do not show the typical contrast between using more abbreviated descriptions with familiar partners versus more elaborated descriptions with new partners (Horton & Spieler, 2007). What is not well understood is the *kind* of information that older and younger adults use in descriptions, and how this relates to factors involving the amount of information provided.

In the present study, a group of 24 young (M_{age} = 19.38) and 24 older adults (M_{age} = 75.33) were told that they would be recording instructions for future players in a referential communication game. The instructions required players to move one of several objects from the left side of a screen display to one of several locations on the right side. Target objects were images of everyday objects that were either unique within the display or were accompanied by another object in the same category (thereby requiring the use of either a subordinate noun or a modifier for referential success). Speakers began their descriptions when the object to be moved was cued with a frame, and the intended location was cued shortly after. Of interest was the nature of the information provided by younger versus older adults when describing the object to be moved.

The results showed that older adults used more modifiers than younger adults overall (p =.035). Interestingly, this was driven primarily by the condition where modification was unnecessary (young: M = 1.21 modifiers; old: M = 3.5; p = .017). Analyses of the types of adjectives used in referential descriptions across conditions showed that color was the most common modifier supplied by both age groups, consistent with past studies of young adults (Belke & Meyer, 2002). However, older adults demonstrated a clear tendency to use a broader range of modifiers beyond color, including notably less typical modifier types. For example, a shirt that could easily be distinguished from a competitor on the basis of color might be called "*the men's shirt*" rather than "*the white shirt*". Importantly, this pattern also held in the contrast-absent condition (a scenario that previous authors have specifically linked to color overspecification, e.g., Tarenskeen et al., 2015) and even when talkers were optimally Gricean in the contrast-present condition, providing just enough information to allow the target to be identified. Although older adults' use of atypical descriptions has been reported in tangram studies (Arbuckle et al., 2000; Hupet et al., 1993), the fact that the pattern is still found with everyday objects suggests it may be highly characteristic of older adults' communication, and not just limited to descriptions for unfamiliar schematic images. Plausible mechanistic explanations for older adults' patterns could involve changes in lexical retrieval efficiency, general "off topic verbosity" (cf. Arbuckle et al.) or reduced inhibitory control during lexical selection.

Together with recent work involving community participants from various educational and socio-economic backgrounds (e.g., Dahan et al., CUNY 2016 presentation), the current results indicate that speakers' strategies in designing referring expressions may be less optimal and less uniform that what has been suggested in the core psycholinguistic literature.

Can phonological influences on lexical-semantic encoding in word production be regulated by the speaker?

Eva Belke, Sprachwissenschaftliches Institut, Ruhr-Universitaet Bochum

Lexical access in language production minimally entails a lexical-semantic and a phonological encoding stage. Analyses of speech errors indicate that these processing stages are coordinated in an interactive fashion. The experimental evidence, by contrast, is mixed, suggesting that in experimental settings, interaction is the exception rather than the rule. Experiments on auditory word processing suggest that interactivity may be subject to attentional modulation (e.g., Mirman et al., 2008).

In two naming experiments, I investigated whether accessing phonological information during lexical access is subject to speaker control. In Experiment 1, speakers were asked to repeatedly name small sets of semantically related or unrelated objects (blocked-cyclic naming). In half of the sets, the majority of the objects' names were phonologically informative; in the remaining sets, the majority of the objects' names were phonologically uninformative. Phonological informativeness was manipulated by means of the phonological neighbourhood of the objects' names, as assessed by the average phonological Levenshtein distance to their 20 closest phonological neighbours, PLD20. When the PLD20 is low, the name's neighbourhood is dense, facilitating phonological encoding as compared to names that have a high PLD20, that is, a sparse neighbourhood. Since a low PLD20 has previously been shown to facilitate word form encoding in comparison to a high PLD20, I hypothesized that in sets with many low-PLD20 object names, speakers might recruit information about the phonological word form of the object name in order to speed up lexical-semantic encoding. In this case, we should see an interaction of a set's semantic context (related, unrelated) and its ratio of low-PLD20 names (many, few) in the naming task. The results show that while an object's PLD20 significantly affected participants' response times, there was no effect of the makeup of the sets (many vs. few object names with low PLD20) on naming times, suggesting that access to phonological knowledge does not depend on whether the naming context is phonologically informative or not. These findings were replicated in Experiment 2, which included semantically related sets only and manipulated phonological informativeness within sets.

It is possible that the manipulation of PLD20 did not affect the interplay between lexical-semantic and phonological interaction because the phonological manipulation was too subtle. In Experiment 3, I used the same sets as in Experiment 2 but combined them with phonologically onset-related sets, i.e. sets that included a clearly perceivable phonological manipulation. However, this did not change the results for the semantically related sets either.

I discuss the implications of these findings for models of lexical access and point out avenues for future research.

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Parallel vs serial messages at the conceptual level of language production

Lewis Bott, Bianca Diaconu, and Alice Rees. School of Psychology, Cardiff University.

Language production can be broken down into a conceptual level, where messages are conceived in non-linguistic form, and a formulation and execution level where they are constructed (Levelt, 1989). While good progress has been made in understanding the formulation and execution levels, little is known about the conceptual level (e.g. Konopka & Brown-Schmidt, 2015). Here we consider whether multiple messages are constructed at the conceptual level in parallel, but only one is formulated, or whether messages can only be conceptualized serially, with each being formulated automatically.

We use message suppression to test between these accounts. If messages can be conceptualized in parallel, suppression could occur by a constraint-based weighting system, in which messages that are inappropriate (e.g. because of politeness, audience design, or deceit) receive a low weighting, and only the most message with the highest weighting is formulated. The suppression of messages should therefore not incur a processing cost. Alternatively, if messages are conceptualized and formulated in serial, then suppression would involve additional stages of formulation. We conducted a production task in which participants were asked to lie about images (suppress them) or to tell the truth. A serial conceptual model predicts that voice onset times (VOTs) for production would be delayed for lie trials relative to truth trials whereas a parallel conceptual does not.



Fig 1. Participants lie about the underlined image, e.g. "The man goes to the park and buys an icecream".

Experiment 1. N = 20. Participants saw three images and were asked to form a sentence using the three images (Fig 1.) When one of the images was underlined, they were told to lie about it, but to describe the image appropriately otherwise. Analysis VOTs showed that lie VOTs were significantly longer than truth VOTs for utterance and NP onset times (t's > 2.92, p's < .01).

The results of Experiment 1 are consistent with a serial conceptual model. However, a parallel model could explain these findings by assuming the lie cost was caused by the time needed to construct an alternative message and not the time needed to suppress one. In Experiment 2 we tested this by introducing a third condition in which there was no third image shown, only a red line (Fig. 2), and the participant had to construct an event but not suppress one. A parallel model would predict no difference between the lie and construction condition whereas a serial model would predict longer VOTs for the lie compared to the construction condition.



Fig 2. Participants construct an event e.g. "The man goes to the park and buys an icecream".

Experiment 2. N=30. Participants were slower generating sentences in the lie and construction trials than in the truth trials, all t's > 2.57, p's < .05, as in Experiment 1, but crucially, there was no significant difference between lie and construction conditions, t's < 1. A Bayes Factor analysis revealed that this was not due to low sensitivity of the experiment, BFs < 0.22. Our data therefore suggests that under reasonable assumptions of effect size, there is no cost to suppressing information, only to constructing its replacement, consistent with a parallel implementation of the conceptual stage.

Discussion. Our data suggests that in at least some circumstances, multiple messages can be conceived and suppressed at the conceptual level. Future research needs to establish why in other circumstances, suppression and alteration of messages occurs at a later stage of production (e.g. Horton & Keyzar, 1996).

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Do Animacy-Syntax Interactions Influence Structural Priming?

Leone Buckle, Elena Lieven & Anna Theakston

ESRC International Centre for Language and Communicative Development (LuCiD),
Coupland 1, University of Manchester, Oxford Road, Manchester, M13 9PL

Sentence production relies on the activation of semantic information (e.g. noun animacy) and syntactic frames that specify an order for grammatical functions (e.g. subject before object; Levelt, Roelofs & Meyer, 1999). However, it is unclear whether these semantic and syntactic processes interact (Gámez & Vasilyeva, 2015). We thus examined the extent to which animacy-thematic role mappings in dative prime sentences and target scenes could influence choice of syntactic structure. 143 participants (47 three-year-olds, 48 five-year-olds and 48 adults) alternated with the experimenter in describing animations. Animacy mappings for themes and goals were either prototypical (animate goal & inanimate theme) or non-prototypical (animate theme & inanimate goal) and either matched or mismatched across the experimenter's prime scenes and participants' target elicitation scenes. Prime sentences were either double-object datives (e.g. *the girl brought the monkey a ball*) or prepositional datives (e.g. *the girl brought the ball to the monkey*). Participants' target sentences were coded for syntactic form. All age groups showed a main structural priming effect. Animacy-semantic role mappings facilitated three-year-olds' prepositional dative priming but did not influence the magnitude of structural priming in any other instance. Our results demonstrate the changing influences of animacy-syntax interactions on sentence production over the course of development and will be discussed in the context of theories of language acquisition and sentence processing.

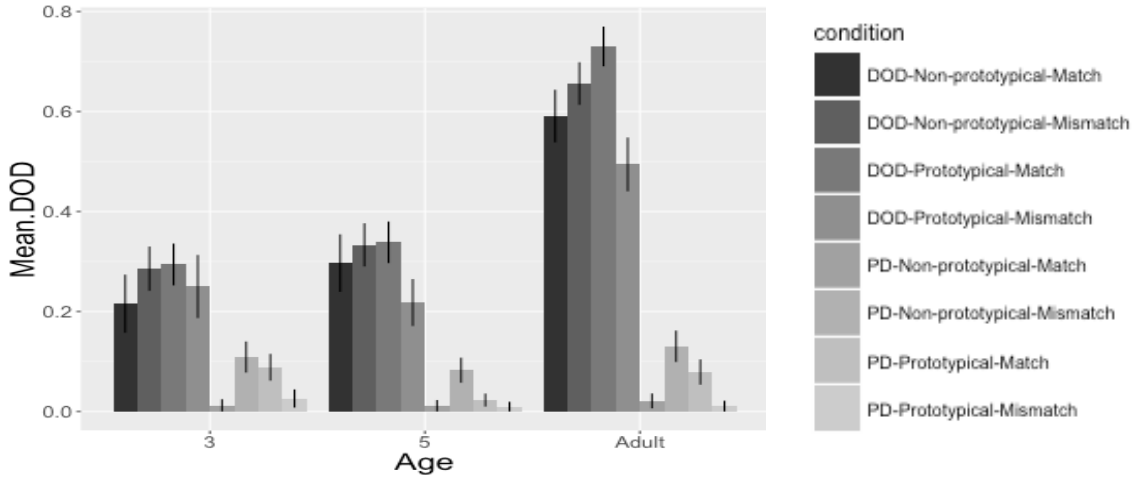


Figure 1: The mean proportion of DOD responses following DOD and PD primes where primes contained either prototypical or non-prototypical animacy-semantic role mappings and these mappings were either matched or mismatched across primes and targets (SE in error bars)

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Parallelism effects in ellipsis with *and*

Katy Carlson, Morehead State University

Ellipsis sentences pose an interesting puzzle for processing, as processors have to use prior content to fill in missing structure. The decisions as to where to find the structure and how much to reuse or reaccess can be complex. Two experiments explore the processing of different types of ellipsis after a multi-clause sentence, finding two layers of parallelism effects. At one layer, ellipses using *and* have an almost categorical preference for additional syntactic structure; at the other layer, only ellipses with *and* respond to parallel contrastive accents. Both cases show that the conjunction *and* leads to high expectations of similarity even within the same ellipsis type.

In Experiment 1, sentences contained embedded infinitive clauses as in (2) and varied what type of ellipsis followed. Conditions (1a-b) show VP Ellipsis, which can occur with the conjunction *and* or subordinating conjunctions (*before, because*, or *after*). Gapping in (1c) requires *and*, while comparatives (1d) require comparative phrases like *more X than*. In all four cases, it is possible for the ellipsis to refer back to the highest clause, meaning that Leah also wants to bake, or to the lower clause, meaning that Leah also baked. Participants in this auditory questionnaire chose between paraphrases of the unelided meaning of 20 sentences. The ellipses using *and* (1a,c) received over 85% high interpretations (*wanted to bake*) while those without *and* (1b,d) got 30-40% high interpretations. Answers for the two VP Ellipsis conditions did not pattern together, as might have been expected. It is clear that the presence of *and* influences the amount of structure that is reused. Since reuse of larger structures in ellipsis does not seem to be more costly than reuse of smaller ones (Martin & McElree, 2008; Frazier & Clifton, 2001), constructions seem free to refer back to either clause if *and* does not favor total parallelism of structure.

In Experiment 2, the VP Ellipsis sentences in (1c-d) were adapted to contain tensed complement clauses, allowing two possible subject contrasts with the remnant Leah (Mika or Dad in (2)). Conditions (2a-b) used *and* and ended with *did too*; conditions (c-d) used subordinating conjuctions and omitted *too*. Conditions (2a,c) placed contrastive L+H* accents on the earlier subject *Mika* and *Leah*; (2b,d) accented the lower subject *Dad* and *Leah*. Participants chose between paraphrases of 20 sentences. Both earlier accent and the use of *and* increased high interpretations, with a significant interaction as well: accent placement only affected interpretation in the conditions with *and* as the conjunction. Surprisingly, prosodic parallelism effects have been shown in comparatives and bare argument ellipsis (Carlson 2001), both without *and*.

The results of Experiment 1 can be seen as related to *and* or to the syntactic requirements of the different ellipsis types: Lechner (2004, 2008) predicts that gapping should only allow the higher interpretation, while VP Ellipsis and comparativies should be ambiguous. But the split in VP Ellipsis responses depending on the conjunction suggests that construction-specific rules are not fully responsible for guiding the different interpretations. The results of Experiment 2 further shows variation in VP Ellipsis preferences, and that *and* is needed for VPE to be influenced by prosodic parallelism (accenting the intended contrasting DPs). The most unifying explanation is that additional similarity at any level between antecedents and ellipsis clauses is more expected with *and*.

(1) a. Mika wanted to bake muffins and Leah did, too. — VPE with *and*
b. Mika wanted to bake muffins before Leah did. — VPE without *and*
c. Mika wanted to bake muffins, and Leah, cupcakes. — gapping
d. Mika wanted to bake more muffins than Leah. — comparative

(2) a. MIKA hoped that Dad baked muffins, and LEAH did too. (72% high)
b. Mika hoped that DAD baked muffins, and LEAH did too. (54%)
c. MIKA hoped that Dad baked muffins because LEAH did. (32%)
d. Mika hoped that DAD baked muffins because LEAH did. (29%)

Effects of normal aging on early experience in a developmental model of reading

Ya-Ning Chang[1], Padraic Monaghan[1] & Stephen Welbourne[2]
[1]Department of Psychology, Lancaster University
[2]Neuroscience and Aphasia Research Unit, University of Manchester

In the domain of language processing, early experience has a profound impact on later processing. An example of this effect is the well-documented phenomenon of age of acquisition (AoA). Several studies have investigated age-related change in AoA effects (e.g., Davies et al., 2017). Recently, Davies et al. (2017) examined the AoA effects across the lifespan from childhood into old age, demonstrating that the AoA effects diminished with age in both lexical decision and naming. They also found a global U-shaped effect of age on response latencies. Previous computational modelling work has simulated the age-related change in cognitive functions such as paired-associate learning (e.g., Li et al., 2000) by reducing the gain of unit activation in neural network models to reflect lower responsivity and noisy cortical representations as a consequence of age-related declines in neuromodulation. However, it remains unclear whether applying this to a large-scale triangle model of reading would account for the aging-related declines in psycholinguistic reading effects, particularly the AoA effects. To test this, we developed a triangle model of reading, incorporating written, spoken, and meaning forms of words, that was trained on a realistic, cumulative exposure to words during learning to read to mirror the developmental stages of reading from children to old age. In particular, we trained a version of the model with gradually reducing neural gain over the time course of learning, where gain of unit activation was reduced incrementally throughout the adult stages of reading. For comparison, we trained a control version of the model without this manipulation.

Behavioural naming and lexical decision latencies were simulated by phonological and semantic error scores, respectively, when written words were presented to the model. The results showed the aging model produced a U-shaped effect of reading training on model performance in both naming and lexical decision similar to that observed in behavioural data. But this was not observed for the control model. For AoA effects in naming, the AoA effect decreased with increasing training for both the aging and the control models. However, in lexical decision, different patterns emerged, in that a decreasing AoA effect was obtained for the control model, whereas the AoA effect initially decreased with training but then gradually increased for the aging model.

Overall, the patterns produced by the aging model are comparable with the age-related data reported by Davies et al. (2017) except the effect size of AoA in the model's lexical decision. The discrepancy might be due to different decision criteria adopted by young and older adults (Ratcliff et al. 2010), which was not simulated in the present model. These results suggest that the introduction of reduced neural gain in the computational model of reading combined with more sophisticated implementations of lexical decision could potentially be applied to address a wider range of individual differences in psycholinguistic effects.

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Memory retrieval as a repair mechanism: evidence from eye-tracking

Wing-Yee Chow & Rosanna Todd
University College London

Previous research has shown that language processing is susceptible to retrieval interference [1-3], but less is known about whether and how comprehenders' semantic interpretation may be impacted [4-6]. For example, would retrieval interference give rise to a wrong interpretation or even semantic illusion? Here we investigated this by asking whether our comprehension of unlikely thematic relations such as "the barber trimmed the hedge" may be impacted by the presence of a plausible agent like "gardener" elsewhere in the sentence. Eye-movement records showed that comprehenders detect implausibility just as quickly and reliably regardless of interference, but the effect of implausibility seems to dissipate sooner when a plausible agent is present elsewhere. Our results suggest that comprehenders' initial interpretation is accurate and not susceptible to interference, but their attempt to repair an implausible interpretation is likely to involve memory retrieval.

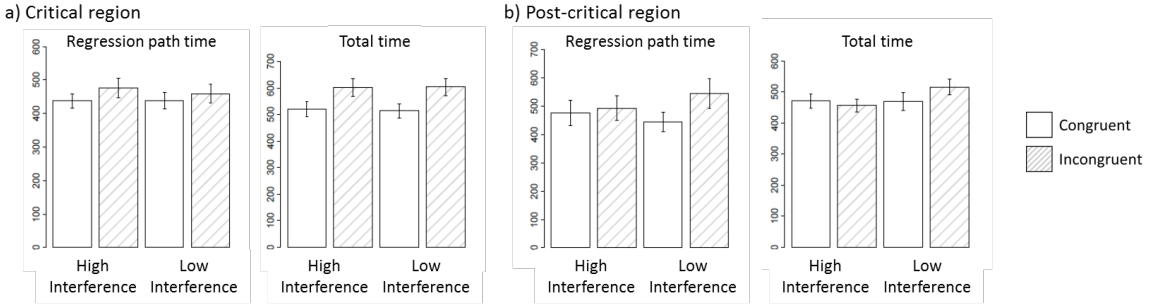
Using 84 sets of bi-clausal sentences modelled on those by [7], we manipulated the plausibility of an event in the second clause by changing the subject (e.g., gardener vs. barber trimming a hedge). The competitor agent appeared as the first clause subject in the high interference conditions; proper names were used in the baseline conditions (Table 1).

Results (n=25) showed a clear main effect of plausibility across different eye-tracking measures in the critical region (Fig 1a). A plausibility x interference interaction was found only in total reading time in the post-critical region, where the plausibility effect was greatly reduced in the high interference conditions (Fig 1b). The robust effect of plausibility shows that comprehenders quickly detected the implausibility regardless of interference, while the late facilitative effect of interference suggests that comprehenders may have "repaired" the implausibility in the high interference condition by retrieving a plausible agent. These results suggest that interference does not impact comprehenders' initial interpretation, but they may use memory retrieval as a repair mechanism when things go wrong.

Table 1. Experimental design and sample stimuli

	Low interference (baseline)	High interference
Plausible	John talked as the gardener trimmed the hedge in the afternoon.	The barber talked as the gardener trimmed the hedge in the afternoon.
Implausible	John talked as the barber trimmed the hedge in the afternoon.	The gardener talked as the barber trimmed the hedge in the afternoon.

Figure 1. Regression path time and total reading time in the critical and post-critical regions.



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Why are figurative expressions more emotionally engaging?

Francesca M.M. Citron[1], Nora Michaelis[2], & Adele E. Goldberg[3]
[1]Lancaster University, [2]Free University of Berlin, [3]Princeton University

Recent neuroimaging research has shown that common metaphorical expressions, e.g., *That was a bitter break up,* elicit stronger emotional engagement in readers than almost identical literal counterparts, i.e., *That was a bad break up;* specifically, the former elicited significantly enhanced activation of the left amygdala (Citron & Goldberg, 2014), associated with processing of evolutionary relevant or contextually salient (emotional) stimuli (Cunningham & Brosch, 2012). This finding was replicated using a range of different metaphorical mappings embedded in natural stories (Citron et al., 2016) and is supported by other neuroimaging research (Bohrn et al., 2012; Forgács et al., 2012) and by converging evidence using psychophysiological measures (Rojo et al., 2014).

This work raises the question as to *why* figurative formulations more engaging. (A) Is it because the activation of embodied representations (i.e., simulation) involves the reader at the physical and emotional level? (B) Or is it that metaphors are perceived as more aesthetically pleasing? (C) Is it because multiple representations (figurative, literal) are concurrently active, and the selection of the appropriate one is in itself pleasurable (such as solving a puzzle)? Evidence from three datasets seems to support (C).

Idioms, e.g., *She spilled the beans,* have shown enhanced amygdala activation compared to literal sentences and concurrent enhanced activity in the left inferior frontal gyrus (IFG), associated with executive functions such as working memory, selection and inhibition, and of the pre-central gyrus, associated with motor (embodied) representations. A functional connectivity analysis showed a positive interaction of the amygdala with the IFG, i.e., when the former increases in activation, the latter does too, but no interaction at all with the pre-central gyrus. This suggests that it is the juggling of multiple semantic representations at once (IFG) that is associated with the emotional response (amygdala; C), while embodied representations (pre-central gyrus) are unrelated (contra A).

In a secondary analysis of neuroimaging data on taste metaphors from Citron and Goldberg (2014), we collected ratings of aesthetic “beauty” for all metaphorical and literal sentences and found the metaphors to be rated slightly higher. However, at the brain level increasing beauty ratings correlated with regions other than the amygdala, i.e., the post-central gyrus, associated with somatosensory representations. Thus, at least in this dataset, perception of beauty evokes representations related to the senses, but no emotional response (contra B).

Finally, neuroimaging data from second language (L2) speakers were collected. While native speakers showed the usual pattern of left IFG and amygdala activation in response to increasing metaphoricity, L2 speakers showed no neural distinction between metaphors and literal sentences; rather, they showed additional recruitment of executive function regions (including IFG) in response to both types of stimuli compared to natives, as well as recruitment of the switching network, associated with language selection and interference between multiple language representations (Abutalebi & Green, 2007). This is because L2 speakers activate multiple meanings (metaphorical, literal) and languages concurrently. L2 speakers also showed left amygdala activation in response to both stimuli, with relatively stronger activation for metaphors. These findings are consistent with the idea that the heightened emotional response stems from the activation of multiple representations and ‘problem solving’, i.e., working out which meaning is the most relevant one, and in which language. This pattern of results is also consistent with (C).

Antecedent Retrieval During the Resolution of Reciprocal Anaphors

Ian Cunnings (University of Reading) & Patrick Sturt (University of Edinburgh)

The role that binding constraints (Chomsky, 1981) play in constraining antecedent retrieval during sentence processing has been widely debated (for review, see Jäger et al., 2017). According to cue-based parsing (Lewis et al., 2016), antecedent retrieval during anaphor resolution should be susceptible to interference. This predicts that in (1), correct retrieval of 'the man' at 'himself' is dependent on the feature-match between the reflexive and all of the antecedents in the sentence, including both the *grammatical* antecedent ('the man') and the *distractor* ('the boy'). However, to date the evidence of interference for reflexives has been mixed (Jäger et al., 2017), unless the grammatical antecedent provides a particularly poor feature-match for the reflexive (Parker & Phillips, 2017).

Although many studies have examined reflexives, very few studies have investigated reciprocal anaphors, as in (2a), where the only grammatical antecedent for *each other* is 'the boys'. This is surprising given that in the linguistics literature reflexives and reciprocals are subject to identical binding constraints (Chomsky, 1981). The only existing study in English examined sentences similar to (2a), and found longer reading times when the distractor ('the girl/s') matched the number of the reciprocal (Badecker & Straub, 2002). We are unaware of any studies in English to have examined both grammatical (2a) and ungrammatical (2b) sentences however. Examining both types of sentence is crucial to testing cue-based parsing, which predicts *facilitation* during reading for ungrammatical sentences when the distractor matches the number properties of the reciprocal.

We monitored participants' eye-movements (n=48) as they read sentences similar to (2a/b), which factorally manipulated the number properties of the grammatical antecedent ('the boy/s') and the distractor ('the girl/s'). Reading times at the reciprocal ('each other') and spillover region ('quite badly at school') were significantly longer for ungrammatical sentences in regression path times and total viewing times (ps < .001). However, we found no significant effects of the distractor in either first-pass, regression-path or total viewing times. The main effects of grammaticality differed across regions in some measures, as evidenced by significant region by grammaticality interactions (ps < .012). In regression path times, grammaticality effects were larger at the spillover region, suggesting such effects take time to fully emerge.

In sum, we did not replicate the effects observed by Badecker & Straub (2002), nor did we find significant evidence of facilitation in the processing of ungrammatical sentences. These results suggest that reciprocals resist interference during processing. As has been claimed for reflexives (Parker & Phillips, 2017), our results suggest syntactic binding constraints constitute more highly weighted cues to antecedent retrieval than morphosyntactic features during the resolution of reciprocals (see also Kush & Phillips, 2014, in Hindi).

(1) The boy said that the man had injured himself by mistake.
(2a) The girl/s said that the boys accidently hurt each other quite badly at school.
(2b) The girl/s said that the boy accidently hurt each other quite badly at school.

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Do speaker-specific cues influence ambiguous word interpretation?

Cat Davies[1], Vincent Porretta[2], Kremena Koleva[3], Ekaterini Klepousniotou[1]
[1] University of Leeds, UK; [2] University of Alberta, Canada; [3]University of York, UK

Addressees use information from speakers' previous discourse to make predictions about incoming linguistic material and to restrict the choice of potential interpretations. Thus, speaker identity has been found to be an influential factor in language processing across multiple linguistic domains, e.g., phonology, syntax, and pragmatics. The current study uses polysemous words with metaphorical extensions, e.g., *head; fork,* which can refer to a dominant, literal meaning as well as to a lower-frequency, metaphorical meaning, to investigate the extent to which speaker-specific cues influence semantic interpretation.

Using an exposure-test design, speaker style was manipulated by training participants to associate a specific speaker with a highly literal or a highly metaphorical style. At test, participants responded to spoken video instructions from each speaker to *'click on the X'* while their eye movements were tracked. We hypothesised that participants would ultimately resolve reference to the literal target (LT, e.g., dinner fork) rather than the metaphorical target (MT, e.g., fork in the road) in both speaker-style conditions due to its meaning dominance. However, if addressees use speaker-specific information to disambiguate referring expressions, we predicted that participants would experience interference from the MT in the metaphorical speaker condition, indexed in that condition by i) longer reaction times for resolution to the LT in the metaphorical style condition; and ii) a lower proportion of looks to the LT while processing the ambiguous noun.

As expected, across speaker conditions, 89% of referring expressions were resolved to the LT and 10% to the MT (the remaining 1% were unresolved before timing out). Contrary to our prediction, there was no effect of speaker style on reaction times. Given the dominance of LT responses, we examined gaze data from noun onset to trial end on trials resolving to the LT. GLMER was used to analyse LT preference (i.e., looks to the LT vs. looks to the MT) as a function of speaker style. A significant effect was found in two critical time windows. In the early window (400-850ms), participants' preference for the LT was significantly reduced in response to the metaphorical speaker (estimate = -1.69, SE = 0.64, $p < .01$), as hypothesised. Conversely, in the late window (850-1300ms), participants' preference for the LT was significantly greater in response to the metaphorical speaker (estimate = 1.62, SE = 0.57, $p < .01$). This suggests early anticipation and interference of the MT in response to the metaphorical speaker. The later preference for the LT in this condition is likely due to participants double-checking the initial interpretation. These patterns reflect listeners' assumptions that the metaphorical speaker may have intended the expressions to have a non-literal meaning.

Our results support accounts proposing that semantic comprehension involves rapid integration of multiple cues including those of a social nature (Rodd, 2017). We provide evidence that speaker style is a contextual determinant in semantic disambiguation using polysemous words. Our findings extend the literature on partner-specific effects to the domain of semantic processing.

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Structural Priming Effects in Japanese Sentence Production: Voice Has Stronger Influence Than Word Order

Ying Deng (The University of Tokyo) and Chie Nakamura (MIT/JSPS)
dengying@phiz.c.u-tokyo.ac.jp

It is known that language users have a tendency to repeat the previously experienced structure. For example, after hearing a passive prime sentence, a speaker becomes more likely to use the same passive structure in subsequent production than after hearing an active prime sentence, which is widely known as structural priming (Bock, 1986). Past research showed effects of priming both with voice (active and passive) and word order (canonical and scrambled) in free word order languages such as Japanese (e.g., Tanaka, 2007). Furthermore, many studies reported that the effect of priming was enhanced when the verb was repeated between prime and target (e.g., Jin et al., 2014 in Japanese). On the other hand, such lexical boost effect has not been observed for word order priming effect (e.g., Deng et al., 2015). Also, Deng et al. (2014) showed that the priming effect is stronger in voice priming than word order priming when they were tested within the same experiment and the verb was repeated between prime and target. The question we addressed in this study is whether stronger voice priming effect compared to word order priming effect is limited to cases where the verb is repeated. Since the previous research found lexical boost effect only with voice priming and not with word order priming, it is unclear voice priming would have stronger effect than word order priming when the verb is not repeated between priming and target.

The current study conducted a structural priming experiment in Japanese sentence production. Our interest is to see whether stronger voice priming effect than word order priming effect would still be observed when the verbs are different between the prime and target pair. In order to compare our results with those from the previous priming studies, we adopted the same picture description paradigm and materials used in Deng et al. (2014). In the experiment, participants (n=34) were asked to read a prime sentence aloud, and then silently read a target verb that appeared in its citation form on the screen. The target picture then appeared and participants were asked to describe the picture using the verb that was given earlier. In 18 sets of experimental items, prime sentences were either an active with scramble (OSV-active) word order or a passive with canonical (SOV-passive) word order as in (1a, b), and target pictures had two human entities that could serve as both agent and patient. The verbs between prime and target were always different.

The results showed a clear voice priming effect, with more SOV-passive sentences being produced after SOV-passive primes (0.08) than OSV-active primes (0.01). On the other hand, participants produced more OSV-active descriptions after OSV-active primes (0.08) than following SOV-active primes (0.04) but no significant difference was observed for OSV-active sentences. With OSV-active sentences, it only showed a marginally significant effect of trial order, which suggests that participants produced more OSV-active in the second part of the experiment.

Our results showed that the magnitude of voice priming is stronger than word order priming effect even when the verb was not repeated between prime and target. Since the OSV-active and the SOV-passive pairs share the same “patient-agent” thematic role order in Japanese, there should be no effect of thematic role priming in this experiment. Therefore, together with the previous studies that showed that voice has stronger priming effect than word order with verb repetition, our results suggest that mapping of the thematic role to grammatical function (voice priming) might have a stronger influence on production process than mapping of the thematic role to linear word order (linear word order priming) when other factors such as thematic role order and lexical representation of verb are controlled.

(1a) OSV-active prime:	akuyaku-o	hiroin-ga	karakat-ta
	villain-ACC	heroine-NOM	tease-PAST
(1b) SOV-passive prime:	akuyaku-ga	hiroin-ni	karaka-ware-ta
	villain-NOM	heroine-OBL	tease-PAST-PASSIVE

Fighting like cats and pies: Meaning competition in interlingual homographs

Anna Maria DI Betta, Jane Morgan, David Playfoot & Marta Borowka
Sheffield Hallam University (UK)

The dominant view of the bilingual lexicon is that native (L1) and non-native (L2) words are stored in an integrated manner and accessed non-selectively (e.g., Dijkstra & Van Heuven, 2002). However, since bilinguals can *selectively use* their languages depending on context, interference from the irrelevant language can be inhibited (e.g., Green, 1998). To investigate the interference and inhibition at play across languages, Macizo et al (2010) required Spanish-English bilinguals to respond according to whether pairs of L2 words coupled together (Pair 1 and 2) were semantically related or not (a Semantic Relatedness Judgment Task). Pair 1 critical trials consisted of an Interlingual Homograph (IH; same orthography but different meaning across languages) and a word related to its L1 meaning (e.g., PIE ["foot" in Spanish] -TOE). Activation of both meanings of the IH produced L1 interference and worse performance on these pairs compared to control ones (e.g., LOG-TOE). Pair 2 critical trials contained the L1 translation of the IH (FOOT) paired with a related word (HAND). Previous inhibition of the L1 reading of the IH (in Pair 1) slowed down the reactivation of this entry (in Pair 2) compared to control pairs. It remains to be established, however, whether the same pattern of results would be observed in proficient bilinguals living in an L2 environment as it is reasonable to assume that L1 activation may be less strong in this case. Also, previous research has only used identical IHs and has not considered whether IHs with *similar* orthographic forms across languages show the same effects. Di Betta et al (2015), for instance, reported that Polish-English bilinguals displayed stronger L1 activation with similar compared to identical IHs using a sentence priming task. The aims of the current study, therefore, were to address the role of global language context and to vary the types of IHs used. **Method:** 28 Polish-English bilinguals living in the UK took part in a Semantic Relatedness Judgement Task involving both identical (e.g., PIES, meaning "dog" in Polish) and similar IHs (e.g., CARAVAN, similar to the Polish word KARAWAN, meaning "hearse"). **Results:** Significantly slower RTs and more errors were found for Pair 1 if it contained the IH paired with a word related to its L1 meaning (e.g., PIES-CAT) compared to a control condition. This effect was significantly greater for similar IHs (e.g., CARAVAN-FUNERAL) than for identical IHs. For Pair 2, performance was slower when Pair 2 followed a Pair 1 containing a similar IH, and when Pair 2 involved a translation of the IH compared to a control word. **Conclusions:** Our results confirm the presence of L1 interference and inhibition in Polish-English bilinguals living in the UK, showing that such effects can still be evident when bilinguals are predominantly exposed to their L2. Furthermore, the L1 meaning was more strongly activated for similar than for identical IHs, replicating previous findings obtained with a different paradigm. This suggests that the degree of orthographic overlap across languages can influence the amount of L1 activation in IHs, a factor which needs to be accounted for in models of the bilingual lexicon.

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Syntactic and Lexical Influences on Relative Clause Attachment Ambiguity Resolution in Turkish

Nazik Dinçtopal Deniz, Boğaziçi University

Background: This study investigates processing of relative clause (RC) attachment ambiguities such as *[$_{NPhigh}$ The father] of [$_{NPlow}$ the author] [$_{RC}$ who was killed last year] was famous*. The ambiguity is due to two possible attachment sites for the RC: NP_{high} or NP_{low}. Cross-linguistic evidence has shown that languages vary with respect to RC attachment ambiguity resolution (see Grillo & Costa, 2014 for a review). Previous research on Turkish (Kırkıcı, 2004; Dinçtopal-Deniz, 2010) showed that Turkish speakers prefer to attach the RC to the low NP. Dinçtopal-Deniz also provided evidence that the low NP attachment preference can be influenced by the lexical properties (i.e., animacy) of the NPs but the syntactic parsing principle of Late Closure (low attachment) still prevails. This study investigates whether working memory (WM) capacity (Traxler et al., 2005) and its interaction with prosodic phrasing of the sentence (Swets et al., 2007) can explain the previously observed animacy effects in RC attachment resolution in Turkish.

Method: 72 native speakers of Turkish participated in a word-by-word self-paced reading task, a pen-and-paper questionnaire, a read-aloud sentence production task and two working memory tests: a digit span and an automated operation span task.

Results: Self-paced reading data showed that participants preferred to attach the RC to NP_{low} in their online parsing decisions, *p*'s < .001. There was neither a main effect nor an interaction involving the animacy of the NPs or WM capacity, *p's* > .05. Results of the offline questionnaire showed that participants preferred to attach the RC to NP_{low} (>60%) but this preference was stronger with inanimate NPs, $t_{(67)} = 6.22$, $p < .001$. The prosodic phrasing data showed the same pattern as the offline questionnaire, $t_{(67)} = 7.13$, $p < .001$. There was no WM effect in these tasks, either (*p's* > .05).

Conclusion: The results show that Turkish speakers rely on the syntactic Late Closure strategy in their online RC attachment preferences. Although lexical information also influences parsing decisions, it appears to be used later, in offline decisions. Individual differences such as WM capacity do not seem to affect RC attachment ambiguity resolution in Turkish. These findings are in line with the arguments for universal, syntax-first parsing (Frazier & Fodor, 1978; Grillo & Costa, 2014).

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Self-Priming of Spatial Frames of Reference: A Cross-linguistic Study

Katharine Donelson and Jürgen Bohnemeyer
University at Buffalo, The State University of New York

Spatial frames of reference are used to locate and orient objects in verbal and nonverbal representations of space. We examine whether utterances in connected speech prime each other for the reference frame types they employ. Furthermore, frame use preference varies with language and culture. English speaking communities favour extrinsically anchoring their reference frames with the bodies of speech act participants; Tseltal Maya communities tend to favour extrinsically anchoring their reference frames with the surrounding landscape (Brown and Levinson (1993), Levinson (2003), Bohnemeyer et al (2015)). Both communities also make use of intrinsic frames. We hypothesized that priming effects could play a role in the cultural transmission of frame use preferences. If frame types self-prime, interlocutors can make each other more likely to use particular frame types, thereby transmitting cultural practices of frame use (cf. Kleinschmidt and Jaeger 2016 for a different domain). This predicts specifically that extrinsic frames, whose use shows the greatest amount of cross-cultural and cross-linguistic variation, prime themselves in connected speech and create a vehicle for cultural transmission. To test this hypothesis, we ran a referential communication task (Clark and Wilkes Gibbs 1986) with speakers of English and Tseltal.

Pairs of participants instructed one another to rebuild arrays containing 2-5 dolls and pieces of doll furniture. The participants were seated at a 90° angle, with a half screen between them such that they could see each other but not the array displayed. There were two trial type conditions: a rotation condition, in which an array had to rotate 90° in order to align with the matcher, and an orientation-maintained condition, in which the array had to maintain its orientation vis-à-vis the environment (Li and Gleitman 2002, Li et al 2011). All participants saw all conditions. Trials were run in blocks and counter-balanced across lists. During each trial, 'director' and 'matcher' communicated until the matcher finished reconstructing the array. The conversations were transcribed and propositions were coded for reference frame use and whether they were preceded by utterances involving the same frame type. We analysed data from directors' contributions to the conversations.

To test our hypothesis, we ran binary logistic regression predicting the likelihood of a reference frame being preceded by itself using language, trial type, and reference frame as fixed factors and participant and list as random factors. We found a main effect for reference frame: extrinsic frames were repeated more than intrinsic frames ($p=0.007$). There was also an interaction effect: Tseltal speakers were more likely to prime in orientation-maintained trials than in rotation trials ($p=0.005$). This shows that extrinsic reference frames may prime more easily than intrinsic frames, providing initial evidence of the postulated mechanism for the cultural transmission of a reference frame preference.

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Subject-verb and object-clitic agreement processing: Similar or different? Evidence from number attraction effects in Spanish

Nerea Egusquiza & Adam Zawiszewski.
University of the Basque Country (UPV/EHU)

Subject-verb number agreement attraction studies strongly suggest that a cue-based retrieval mechanism underlies sentence comprehension. Some researchers have argued that subject-verb number agreement and referential dependency processing rely on qualitatively different retrieval mechanisms [1,2]. Whereas subject-verb number agreement attraction experiments consistently show attraction-based interference in ungrammatical sentences -and often in grammatical sentences too- referential dependencies such as reflexive-antecedent and pronoun-antecedent seem to be immune to such effects [3].

Here we investigated the generality of these assumptions by testing attraction effects in another type of agreement dependency: object-clitic agreement. Crucially, Spanish clitics exhibit pronominal and agreement-like behaviour [4]. Will subject-verb and object-clitic agreement, two superficially similar dependencies, show an identical interference profile or not? If both dependencies share a qualitatively similar cue-based retrieval mechanism for sentence processing, they will show an identical interference profile. Otherwise, their interference profiles will differ from each other.

We conducted two self-paced, word-by-word, reading experiments (n = 36). 48 sentences were arranged in a 2x2 counterbalanced design with grammaticality (grammatical/ungrammatical) and attractor number (singular/plural) as factors. The auxiliary verb (Exp.1) and the object clitic (Exp.2) agreed in the grammatical conditions with the subject of the matrix sentence and the object of the main clause, respectively (e.g. Exp.1: *The reporter [who greets that/those minister(s) daily] has/*have written this morning on the newspaper*. Exp.2: *The reporter [who greets that/those minister(s) daily] him$_{sg}$/*$_{pl}$ has been hired this morning on the channel*.)

Our results support the idea that cue-based retrieval was triggered regardless of sentence grammaticality (Fig.1 and 2). Cue-matching attractors elicited inhibitory and facilitatory interference effects in grammatical and ungrammatical sentences, respectively, in object-clitic and S-V agreement; suggesting thus that a single, direct-access, cue-based retrieval mechanism for sentence processing underlies both dependencies.

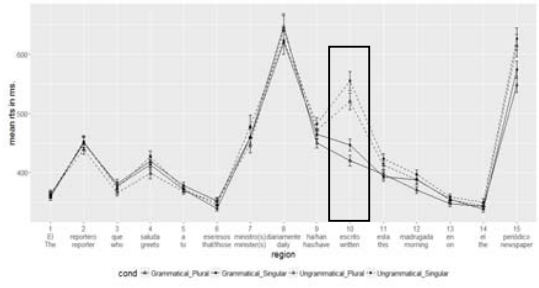


Fig. 1. Exp.1. Subject-verb agreement. Word-by-word, raw mean reading times in milliseconds.

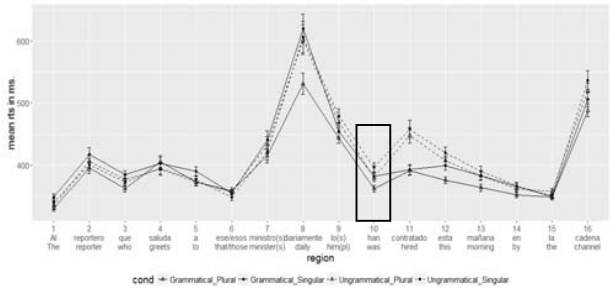


Fig. 2. Object-clitic agreement. Word-by-word, raw mean reading times in milliseconds.

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Cross-linguistic acquisition of complex verb inflection in a connectionist model

Felix Engelmann[1], Sonia Granlund[2], Joanna Kolak[1,3], Ben Ambridge[2], Julian Pine[2], Anna Theakston[1], and Elena Lieven[1]

[1] *University of Manchester,* [2] *University of Liverpool,* [3] *University of Warsaw*

Usage-based approaches to language learning suggest that the acquisition of inflectional morphology and errors made by young learners are a function of the statistical properties of the input (e.g., Bybee & Moder, 1983). It has been shown that purely exposure-based computational models such as neural networks can acquire English verb and noun inflection (e.g., Plunkett & Juola, 1999) and also the complex system of Serbian noun morphology (Mirković, Seidenberg, & Joanisse, 2011).

We investigated to what extent a single exposure-based mechanism can predict human error patterns in the acquisition of verb inflection for the two morphologically complex and dissimilar languages Polish and Finish. Polish inflectional suffixes are highly complex compared to a fairly regular system in Finnish. On the other hand, Finnish features more complex stem alternations than Polish. We trained neural network models on the task of producing person/number inflected present-tense verb forms in Polish (PL) and Finish (FI) and compared the simulations with experimental results of elicited-production studies with children at the age of about 50 months.

Three-layer network models were presented with phonological representations of verb stems (e.g., PL: /rɨsuj/; FI: /roikːu/) together with a code for one target person/number context on the input layer and were trained to produce the inflected form on the output layer (e.g., PL: /rɨsujɛʃ/; FI: /roikut/ for 2nd singular). In each language, 800 present-tense verbs (PL: 2419 forms; FI: 1785) were presented probabilistically during training according to their token frequencies in child-directed speech corpora. By limiting the intermediate layer to 200 units, the models were forced to generalise rather than rote-learn by extracting regularities in the input.

The models could correctly inflect over 99% of the trained verb forms after seeing 500,000 (PL) and 250,000 (FI) examples and correctly generalised 96% (PL) and 90% (FI) of unseen tokens. Both models showed faster and more accurate acquisition for inflected forms with a high token frequency and with high phonological neighbourhood density (PND; a measure of phonological analogy). Suffix errors often resulted from overgeneralisation (i.e., producing the correct person/number context but from a different inflectional class) and occasional substitutions of low-frequency forms with higher-frequency forms (e.g., producing 3rd singular instead of 1st singular). These results are consistent with our experimental findings. In addition, the simulations showed an interaction between frequency and PND in certain training stages, such that low-frequency forms benefited more from PND than high-frequency forms. This interaction was, however, not significant in the experimental data.

Our results suggest a common cross-linguistic learning mechanism underlying the acquisition of inflectional morphology that is sensitive to subregularities in the input. We discuss cross-linguistic differences and detailed error patterns at different training stages.

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The use of parafoveally-viewed expectation and frequency information by L2 speakers of English

Leigh B. Fernandez (University of Kaiserslautern), Nicolette C. Pire (Northeastern University), & Shanley E.M. Allen (University of Kaiserslautern)

While native speakers use information rapidly during processing to anticipate upcoming sentence content, L2 speakers do so less efficiently. Previous explanations for this difference include factors like frequency and lexical representation (Kaan, 2014), as well as reduced ability of L2 speakers to generate expectations (RAGE; Grüter et al., 2014). However, we hypothesize that these differences may (in part) be explained by the reduced perceptual span (the area outside of the highest level of visual acuity) of L2 speakers (Leung et al., 2014). Research has shown a L1 benefit when previewing frequent and expected words in the perceptual span while reading (e.g. Schotter et al., 2013).

The current study uses an eye-tracking boundary paradigm to test the use of prediction and frequency information in the perceptual span during reading in L1 and L2 speakers of English. The critical words were manipulated in a 2x2x2 design: frequency (high(HF)/low(LF)), expectation (high(HE)/low(LE)), and masking (unmasked/masked). For masking, the critical word was either unmasked during reading or masked with a non-word in the perceptual span and changed to the critical word upon making a saccade across an invisible boundary. Critical words were controlled for frequency, syllable count, stress, and length, and their expectation was judged by 84 native English speakers.

Two groups were tested: native English speakers (n=22) & L2 English speakers (n=22). Gaze duration (GD) shows: LF>HF, masked >unmasked, and two interactions (1) language x masking–L2 did not differ between masking conditions but L1 shows longer GD for the masked condition (2) masking x frequency–HF shows a parafoveal benefit for both groups. Total duration (TD) shows: LF>HF, masked>unmasked, LE>HE, L2>L1, and a four-way interaction. In HE constructions where parafoveal information is present frequency effects disappear for native speakers and in masked HE contexts there is a parafoveal preview benefit only for LF items. We see this same pattern for L2 speakers but only in constructions that are not expected.

Main effects are in line with predictions. Masking evokes differing GD interactions for the L1 group, but when collapsed across groups there is a parafoveal benefit for HF items. Additionally, we see interactive effects in TD whereby both groups benefit from parafoveal information for LF items, albeit under different expectation contexts. This suggests that L2 speakers make use of parafoveal information despite their smaller perceptual span, but are affected differently by expectation compared to L1 speakers (in TD). If L2 speakers are limited in their ability to generate expectations it does not stem from their inability to use parafoveal information to facilitate the processing of upcoming words.

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Contextual Characteristics of Concrete and Abstract Words

Diego Frassinelli, Daniela Naumann & Sabine Schulte im Walde (University of Stuttgart)
frassinelli@ims.uni-stuttgart.de

The literature about conceptual representation has extensively debated about the nature of concrete concepts, but much less has been said about abstract concepts and the similarities and differences between these two classes (Murphy, 2002). According to Barsalou and Wiemer-Hastings (2005), concrete concepts are directly grounded in the sensory-motor system, while abstract concepts are mapped to concrete concepts in order to be processed. Distributional semantics represents a very powerful approach to investigate word meaning in a data-driven fashion: the distributional hypothesis states that we can infer the meaning of a word by looking at the linguistic context it co-occurs with (Turney & Pantel, 2010).

Hypothesis. The aim of this work is to quantitatively investigate similarities and differences between concrete and abstract words by looking at the concreteness ratings (CRs) of their respective linguistic contexts (co-occurrences). Based on the literature, both concrete and abstract words should primarily co-occur with other concrete words.

Materials. Noun-noun co-occurrences have been computed from the 16 billion tokens ENCOW14 English web corpus (Schäfer, 2015). For each noun, we extracted the CR (1=abstract to 5=concrete) from the Brysbaert et al. (2014) collection.

Study 1. After computing the cosine similarity between pairs of target words, we selected the 16 top nearest neighbors (NNs) of each target. We analyzed the relation between the CR of each target and the average CR of its NNs. A linear mixed effect (LME) analysis indicates that an increase in CR for the target corresponds to a significant increase in the average CR of its NNs ($\beta_{\text{concTarget}}=0.22$, $p<.001$).

Study 2. After grouping the targets in five sets according to their CRs, we averaged the CRs of their first 2 to 256 most frequent context words. A LME analysis shows a significant difference between the data in the five sets (e.g., increasing the concreteness of the target corresponds to a significant increase in the average concreteness of its context words, $\beta_{\text{concTarget}}=.189$, $p<.001$); a significant negative effect of frequency ($\beta_{\text{freqContext}}=-0.03$, $p<.001$) and a significant negative interaction between the two has been found ($\beta_{\text{concTarget:freqContext}}=-0.005$, $p<.001$).

Study 3. Each target is represented as a 9-dimensional concreteness vector (one dimension per CR): each dimension represents the sum of frequencies of each context word having a specific CR. 60% of the contexts of abstract words are abstract (CR<2), and 45% of the contexts of concrete words are concrete (CR>4).

Discussion. Overall, the three studies show consistent results. Concrete words predominantly co-occur with other concrete words, while abstract words co-occur with abstract words. The results for the concrete words are fully aligned with multiple studies in the literature. On the other hand, our results seem to disagree with the grounding hypothesis for abstract words: abstract words do not share the same context as concrete words. Further investigation is required to support our preliminary findings.

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Predicting Upcoming Words in L2 Sentence Processing: an Eye-tracking Study

Verónica García Castro
University of York
University of Costa Rica

The ability to predict upcoming linguistic material is crucial for efficient communication (Kutas *et al.*: 2011). While a number of studies have shown that word prediction is possible in adult monolingual speakers (Altmann & Kamide: 1999; Borovsky *et al.*: 2012) there is debate as to the extent that adult second language (L2) speakers predict to the same extent during sentence comprehension (Kaan: 2014; Martin *et al:* 2013). Research suggests that this may depend on proficiency and/or speed of lexical access, and this, together with the fact that individual differences can be found in almost all cognitive activities (Eysenck & Kane, 2015), in turn suggests that individual differences in such factors may impact L2 prediction in real-time processing. We explore this issue in the current experiment, investigating the effects of phonological short term memory, verbal intelligence, and vocabulary size on the L2 prediction of upcoming words. 25 adult native L2 learners and 25 English controls took part. In order to keep the lexical knowledge constant, participants were trained on a set of 21 pseudowords (14 verbs and 7 nouns) like "gwap" "fusk," which were then inserted into English sentences. The treatment consisted of a learning/training phase where participants read 24 repetitions of these novel items set in meaningful (English) sentences. After the training task, participants immediately undertook a recognition and recall test. Predictive processing was tested through a visual-world eye-tracking (day 2) (modelled on Altmann & Kamide, 1999), in which participants heard a sentence, while simultaneously viewing a visual scene containing the target (novel item, i.e "gwap") and two distractors. Looks towards the novel item upon hearing "gwap" was taken to indicate prediction. The results of this study will contribute to the understanding of individual differences in L1 and L2 predictive processes and inform theories of L1 and L2 sentence processing.

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Verb-specific lexical information in Hebrew filler-gap dependency formation

Kayla Gold-Shalev and Aya Meltzer-Asscher (Tel Aviv University)
kaylabg@gmail.com

Much research has investigated whether and when lexical information affects filler-gap dependency formation, with inconclusive results. Recently, Wagers & Phillips (2014, Experiment 3) tested whether comprehenders are sensitive to the identity of the preposition heading the filler and its match to the verb's requirement while forming dependencies online. The authors reported increased reading times (RTs) at and after the verb when the filler was headed by a mismatched preposition, and took this to indicate sensitivity to this type of information in dependency formation. However, these long RTs can just as well reflect insensitivity to the type of preposition, resulting in association between the verb and a filler with a mismatched P and detection of ungrammaticality (see Boland et al., 1995 for a comparable interpretation with regard to semantic match).

The current self-paced reading experiment (N=44) manipulated the *filled-gap effect* (e.g. Stowe, 1986) to investigate whether a mismatch in syntactic category or preposition is taken into account in filler-gap dependency formation, in an attempt to gain more direct evidence as to whether or not a dependency was formed with incompatible fillers. Materials included 32 sets of grammatical Hebrew sentences, manipulating the match between the filler and the first verb in the sentence, with 24 filler sentences.

Table 1: Example set and mean reading times (SD) in the filled-gap position (underlined)

if-clause (baseline)	Me'ir lo zoxer im ha-ganenet azra bi-zrizut la-saya'at ha-maxlifa le-hitkašer la-horim etmol ba-boker. 'Me'ir doesn't remember if the kindergarten teacher helped quickly the substitute teacher to call the parents yesterday morning.'	652.6 (249.2)
Match	Me'ir lo zoxer **le-eilu horim** ha-ganenet azra bi-zrizut la-saya'at ha-maxlifa le-hitkašer etmol ba-boker. 'Me'ir doesn't remember **to which parents** the kindergarten teacher helped quickly the substitute teacher to call yesterday morning.'	707.5 (335.6)
Syntactic category mismatch	Me'ir lo zoxer **eilu horim** ha-ganenet azra bi-zrizut la-saya'at ha-maxlifa le-adken etmol ba-boker. 'Me'ir doesn't remember **which parents** the kindergarten teacher helped quickly the substitute teacher to update yesterday morning.'	693.1 (289.9)
Preposition mismatch	Me'ir lo zoxer **be-eilu horim** ha-ganenet azra bi-zrizut la-saya'at ha-maxlifa linzof etmol ba-boker. 'Me'ir doesn't remember **in which parents** the kindergarten teacher helped quickly the substitute teacher to reprimand yesterday morning.'	645.5 (234.9)

Note: *azra* 'helped' in Hebrew takes a PP complement headed by *le-* 'to'.

Reading times at the filled-gap position (underlined in Table 1) displayed a filled-gap effect when the filler matched the verb in syntactic category and preposition ($F_1(1,43)=4.742$, $p=0.035$; $F_2(1,31)=5.524$, $p=0.025$), but not when it mismatched in syntactic category ($F_1(1,43)=3.438$, $p=0.071$; $F_2(1,31)=2.077$, $p=0.160$) or preposition ($F_1(1,43)=0.164$, $p=0.688$; $F_2(1,31)=0.066$, $p=0.799$). This suggests that the parser did not associate the filler with the verb when either type of mismatch occurred, reinforcing Wagers & Phillips' (2014) conclusions.

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Effects of Lexical Meaning on Aspectual Interpretation

Gregory C. Hoffmann and David J. Townsend

Montclair State University

The present work examined processing durative adverbials (*throughout the day*) and frequency adverbials (*repeatedly*). In the sentences, adverbs appeared at the end of a prepositional phrase; follow-up questions were asked about aspectual meaning. We utilized eye tracking methodology to examine two hypotheses.

Our iteration hypothesis in study 1 stated, if iteration (multiple occurrences of an event) is cognitively costly, eye fixation time on durative adverbs (*throughout the day*) will be longer for bounded verbs (*sneezed*) than for unbounded verbs (*slept*). 48 native English-speaking undergraduates read sentences such as *The student (sneezed / slept) in the back of the classroom (throughout the day / every day) during the semester* (from Brennan & Pylkannen, 2006). On durative adverbs, second pass time was longer by items for unbounded verbs than for bounded verbs (376 vs 305 ms, $F1$ (1, 47) = 2.492, p = .121, $F2$ (1, 23) = 7.603, p = .011 using residual reading time). In addition, there were no significant effects of verb type in first pass or total fixation time. These results demonstrate that durative iteration does not incur a processing cost. Our bounding hypothesis in study 2 stated, if bounding a durative situation is cognitively costly, eye fixation time on frequency adverbs *(repeatedly*) will be longer for unbounded verbs (*looked for*) than for bounded verbs (*ignited*). 48 native English-speaking undergraduates read sentences such as *The man (ignited / looked for) a candle on the table (repeatedly / last night) after he lit a match.* This hypothesis was supported, whereby our measure of total fixation time on frequency adverbs was longer by items on unbounded verbs than on bounded verbs (623 vs 561 ms, $F1$ (1, 47) = 3.449, p = .070, $F2$ (1, 23) = 5.121, p = .033 using residual reading time). The bounding hypothesis was also supported in regressions, whereby regressions out of the end of the sentence (*after he lit a match*) were significantly more common by subject for unbounded verbs than for bounded verbs (65% vs 55%, $F1$ (1, 47) = 6.332, p = .015, $F2$ (1, 23) = 3.081, p = .093). The results for regressions demonstrate that participants return to earlier regions more often in sentences with unbounded verbs vs bounded verbs.

These studies show that in free reading setting boundaries to a durative situation is costly but forming an iterative interpretation of a bounded event is not (cf., Brennan & Pylkkanen, 2008; Paczynski et al., 2014). Future studies will uncover more details of the mechanisms of adverbial processing.

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How to compute the meaning of the gradable adjective *tall*

Seungjin Hong[1], *Jean-Pierre Koenig*[2]

University at Buffalo, SUNY

Every day, we encounter objects and automatically compute whether or not they are *tall*. How do we do it? Most studies have proposed that speakers set a cutoff point for tallness on the basis of the mean height of a set of objects we use as a comparison set (Klein, 1980; Kennedy, 2007; Syrett et al., 2010). (See, though, Lassiter and Goodman, 2015 or Schmidt et al., 2009 for computational models of speakers' behavior that do not necessarily make this assumption.) Very few studies have experimentally investigated strategies speakers use to determine whether an object is tall and most only investigated simple scenarios, for example, cases where the objects' heights are evenly spaced (e.g., ranged from 1 to 9 in. in height) (Barner and Snedeker, 2008). The purpose of our study was to (1) examine other strategies people may use in more realistic situations, (2) determine whether the presence of "big jumps" in objects' heights (discontinuities) has an effect on speakers' judgments (and therefore is another strategy people may use), (3) investigate whether the arithmetic mean (or median) can always form the basis of people's judgments of tallness.

To find out what effect discontinuities in height may have on judgements of tallness, we conducted an experiment where participants segregated three arrays of objects into those that are tall and those that are not tall. Three kinds of objects that belonged to made-up categories were successively set on a table. Each set contained 20 objects. In the first set, a large discontinuity in height occurred between the bottom 65% and top 35% of objects. In the second and third arrays, the large discontinuities in height occurred between the bottom 75% and top 25% of objects and the bottom 90% and top 10% of objects, respectively. Participants successively decided for each array which objects were tall by putting tall objects in a predetermined location. The possible six orders of arrays were equally distributed across participants to minimize effects of order of presentation. We had two predictions: (1) participants would preferentially choose as cutoff points of tallness objects whose heights followed the discontinuity; (2) the effect would be larger for the array where a large discontinuity in height occurred between the bottom 75% and top 25% of objects, as Barner and Snedeker found that speakers tend to choose the 25th percentile as a cutoff point.

Both predictions were borne out. Participants chose as cutoff points the height that just followed the discontinuity in height more than any other height for all three arrays. Three Fisher exact tests showed that there were significantly more participants that chose a particular height as a cutoff point for tallness if it followed a particular discontinuity (60%, 75%, 90%) than if it did not (all *p*s $< .001$). Furthermore, the effect size was larger when the discontinuity segregated the top 25% of objects from the other objects (effect size = .55) than when it segregated the top 10% (effect size = .28) or the top 40% (effect size = .38). The results of our study suggest speakers use discontinuities in height, when present, to set up appropriate cutoff points for tallness. The fact that the effect size was largest when the discontinuity was between the top 25% and bottom 75% of objects confirms Barner and Snedeker's finding that the 25th percentile play a particularly important role in judgments of tallness. It also suggests that discontinuities supplement strategies based on either heights or proportions of objects. Finally, as objects' heights were not equally spaced in any of our arrays, the particular importance of the 25%-75% discontinuity evidenced by the increase in effect size cannot

[1] shong23@buffalo.edu
[2] jpkoenig@buffalo.edu

Syntactic Complexity Does Not Account for Comprehension Difficulty Beyond Ambiguity: A Case on Mandarin Relative Clause Processing

Yaling Hsiao (U of Oxford), Jinman Li (SUFE), Maryellen MacDonald (UW-Madison)

Processing of Mandarin relative clauses has been examined extensively due to its typological uniqueness and inconsistent findings. Unlike patterns in many other languages, Mandarin object relative clauses (ORs) may be easier than subject relatives (SRs), making them important in theories of how syntactic complexity affects relative clause (RC) interpretation. Recently, studies investigating the role of ambiguity using corpus analyses and sentence completion suggest that the main clause modifying position affects processing of SRs and ORs differently (Hsiao & MacDonald, 2013, 2016; Jäger et al., 2015; Mansbridge et al., 2017). It is not clear, however, whether difficulty in Mandarin RC ambiguity resolution could supplant or supplement accounts resting on syntactic complexity. The current study examines how the effect of structural complexity stands on explaining comprehension difficulty after taking into account ambiguity indexed by production choices sampled from the identical items.

Exp.1: A self-paced reading study (N=32) crossed RC type and RC modifying position. Length-adjusted log RTs were fitted to mixed-effect models. As shown in Fig1, subject-mod RCs were read faster than object-mod RCs throughout. ORs were easier than SRs at W2 (replicating Hsiao & Gibson, 2003; Gibson & Wu, 2013), whereas SRs were easier than ORs at the head noun (replicating Lin, 2006; Vasishth et al., 2013).

Table1	**Subject Relative (SR)** (W1=praise, W2=director)	**Object Relative (OR)** (W1=director, W2=praise)
Subject-mod	…[称赞 导演 的] 演员 感谢了 编剧… …[praise director DE] actor thanked screenwriter… the actor that praised the director thanked the screenwriter	…[导演 称赞 的] 演员 感谢了 编剧… …[director praise DE] actor thanked screenwriter… the actor that the director praised thanked the screenwriter
Object-mod	…编剧 感谢了 [称赞 导演 的] 演员… …screenwriter thanked [praise director DE] actor… the screenwriter thanked the actor that praised the director	…编剧 感谢了 [导演 称赞 的] 演员… …screenwriter thanked [director praise DE] actor… the screenwriter thanked the actor that the director praised

Exp.2: Gennari & MacDonald (2008) used "gated" sentence completions to track English readers' expectations and found that ambiguity (i.e., the rate of non-RC completions for an RC-beginning sentence fragment) predicted reading times at points that forced the RC interpretation. We collected completions for Exp.1 items at three points, matching the W1, W2 and the relativizer DE in the RC (N=84). Fig.2 shows the rate of non-RC completion, signaling the ambiguity at each gate. After we added Gate1 RC completion rate to the Exp.1's multilevel model at W2, previously significant RC type effect became non-significant. Again, adding Gate3 RC completion rate, and a Gate3-Gate2 difference score (reflecting the degree to which early alternative interpretations are contradicted at DE, i.e. the slope of the lines in Fig.2), the RC type effect diminished to being non-significant. Whereas RC type was robust in the Exp.1 analyses, it no longer predicted RTs with the addition of the completion data. This shows that RC difficulty in Mandarin stems from ambiguity resolution difficulty, and syntactic structure by itself does not add to an account of comprehension difficulty. We also discuss expectation-based information theories, such as surprisal and entropy reduction.

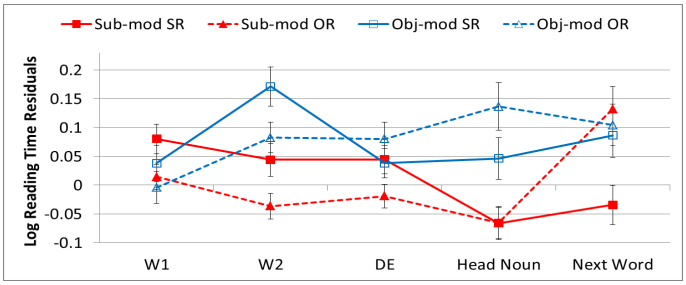


Fig.1 Length-adjusted log reading time residuals in Exp.1 (W1: RC verb for SRs & RC noun for ORs; W2: noun for SRs & verb for ORs, DE=relativizer).

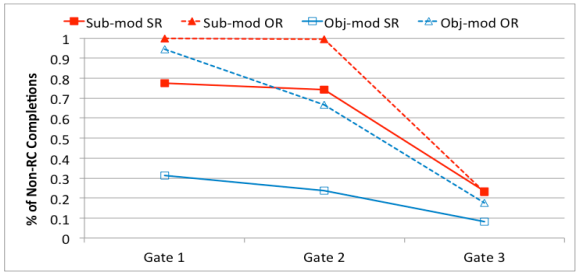


Fig. 2 The percentage of non-RC completions at the three Gates in Exp.2

The production of relative clauses in Cantonese: subject preference and variation

Jiaying HUANG, Caterina Donati

This study is about elicited production of relative clauses (RCs) in Chinese Cantonese. Three hypotheses have been proposed: for the canonical word order hypothesis (Bever 1970) for each language, a RC similar to the canonical word order should be easier to process; for the linear distance hypothesis (Gibson (1998, 2000)) the shorter the *linear* distance between the filler and the gap, the easier the structure; for the structural distance hypothesis (O'Grady 1997) what counts is *structural* distance: the fewer nodes between the filler and the gap, the easier the structure. While the first two predict that different languages exhibit different preferences for subject or object RCs', the latter predicts a universal subject preference. The facts concerning head final RCs are still debated and mostly based on perception data (Hsiao-Gibson 2003 vs. Lin-Bever 2006).

This study is about production of RCs in Cantonese, SVO language with head-final RCs and a wide variation in the form of RCs (with relativizer, **1**, with demonstrative & classifier, **2**, and with both, **3**). Previous researches showed a subject preference in perceptive data (weaker with **1**, and stronger with **2**: Pozniak 2016) and an overwhelming subject preference in children's production (Lau 2006). Is adult production coherent with the perceptive and acquisition data? How preference correlates with syntactic variation?

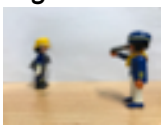
Example: the fire-fighter who is lighting the steward

Form1 with **relativizer** | **Form 2** with **dem & cl** | **Form 3** with **both**

照-住 空姐 **嘅** 消防员 | 照-住 空姐 **嗰–个** 消防员 | 照-住 空姐 **嘅** **嗰–个** 消防员

lighting steward **rel** firefighter | lighting steward **dem-cl** firefighter | lighting steward **rel** **dem cl** firefighter

We ran an elicited production task, with 20 native speakers: each received 8 cards (each with 4 photos: fig 1) and was told that the researcher had an incomplete card with no accessories and a different order of pictures (fig 2). They were asked to help by answering questions like *Which fire-fighter is holding an axe?* The expected answers were a subject RC (sub-condition: *the firefighter who is greeting the hostess*) or an object RC (ob-condition: *the firefighter that the hostess is watching*).

fig 1  **fig 2** 

Out of 1241 productions, we found a robust preference for subject RCs: subject RCs were produced in 97% of sub-conditions, while object RCs were produced only in 7% of obj-conditions. In most cases, object RCs avoidance translated into a passivization, hence subject RCs (91%).These results are coherent with the comprehension and acquisition data and confirm the predictions of the structural distance hypothesis. As for syntactic variation, the overall preference for the form 2 (59%) was significantly higher in obj-condition (73%) than in subj-condition (56%). This correlation between syntactic variation and RC extraction was also found in the perceptive data quoted above. An interesting puzzle arises however, since our participants, when faced with the difficult task of object RC *production* appear to opt for the very syntactic strategy (form 2) which is most biased towards subject RC in *perception*.

Chen et al 2010. Processing Chinese RCs: Evidence for the universal subject preference. ms. **Hsiao Gibson 2003.** Processing of RCs in Chinese. *Cognition 90*. **Lau 2006.** The acquisition of RCs by Cantonese children: An experimental approach. Hong Kong. **Lin Bever 2006.** Subject preference in processing Chinese RCs. *WCFL* Seattle. **Pozniak et al 2016.** Competition of linear and structural distance in RCs processing-Evidence from Mandarin and Cantonese Visual World experiment.

Speakers' social identity affects source memory for novel words

Sara Iacozza[1], Antje S. Meyer[1, 2], Shiri Lev-Ari[1]
[1]Max Planck Institute for Psycholinguistics, Nijmegen, [2]Radboud University, Nijmegen

Previous literature has repeatedly shown that we spontaneously encode people's social features when processing information they provide. This phenomenon leads to specific biases in source memory. That is, people are more likely to misattribute utterances to members of the same social category as the correct speaker than to individuals who belong to different categories. Further evidence suggests that this mechanism depends on how self-relevant the speaker's social category is for the perceiver: the more self-relevant, the more likely it will be encoded along with the information provided. Analogously, Sumner et al. (2013) have suggested that the social weight ascribed to particular speakers and contexts modulates how linguistic input is processed and stored.

In this study, we tested whether social information indeed influences word learning. Specifically, we tested whether the use of social information depends on a) its relevance for the learner and b) the in-group status of the speakers. Participants (N=124) learned competing novel labels for novel gadgets from speakers who supposedly attend different schools. Crucially, half of the participants learned labels from speakers attending their own school (in-group) or a neighboring school (out-group), and the other half learned from speakers attending self-irrelevant schools. Later, participants were tested on their memory regarding who produced which label (see Fig1). Results indicated that learners encode the speakers' school when learning the labels, as indicated by greater within-school confusions than between-schools confusion (β=0.14; SE=0.04; z=9.88; p=.0001), but significantly more so when the schools are self-relevant than when they are not (β=-0.08; SE=0.02; z=-2.41; p=.016). Results also showed that participants were marginally more likely to rely on school affiliations when learning from in-group vs out-group members, but only when individual differences in in-group biases were controlled for (β=-0.05; SE=0.03; z=-1.66; p=.096).

Our results demonstrate that speakers' social categories are indeed represented along with the novel lexical items, but mostly when the social information is self-relevant for the learners. These results indicate that language learning and processing depend not only on the input we receive but also on whom we receive it from.

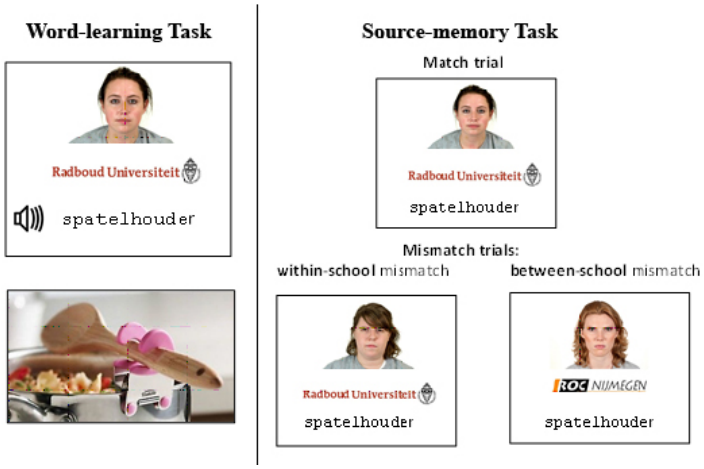


Fig 1. Schematic representation of the experiment.

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How robust are effects of semantic and phonological prediction during language comprehension? A visual world eye-tracking study.

Aine Ito <aine.ito@ling-phil.ox.ac.uk> & E. Matthew Husband (University of Oxford)

Prediction is often assumed to play a crucial role during language comprehension (Kuperberg & Jaeger, 2016). However, recent studies questioning the robustness of prediction (e.g., Nieuwland et al., 2017) suggest that prediction of phonological information may be particularly limited compared to prediction of other linguistic (e.g., semantic) information. We tested this hypothesis by comparing effects of semantic and phonological prediction in a visual world eye-tracking study.

Participants heard sentences where a target word was highly predictable (e.g., "*That dog looks so happy, wagging its tail*…"; cloze *M* = 95%) or unpredictable (e.g., "…, *click on the picture of the*…"), while viewing an object representing the target word (***tail***), its semantic competitor word (***paw***), its phonological competitor word (***table***), or an unrelated word (***daisy***). If participants predict any information about target words, they should fixate target objects over unrelated objects before the target word onset in the predictable condition, but not until the target word onset in the unpredictable condition. Similarly, if they predict semantic or phonological information, they should fixate semantic or phonological competitors over unrelated objects before the target word onset.

Target objects and semantic competitors attracted more fixations than unrelated objects before the target word onset in predictable sentences and after the target word onset in unpredictable sentences (Figure, top). No effect of phonological competitor emerged in either predictable or unpredictable sentences; moreover, we found no phonological competitor effect in predictable sentences, even in an analysis of a subset of items that showed similarly robust phonological- and semantic competitor effects in unpredictable sentences (Figure, bottom).

Phonological prediction does not seem to be as robust as semantic prediction. These results suggest that people often predict broad meaning (e.g., semantic category), but they may only rarely if ever predict specific word forms during natural language comprehension.

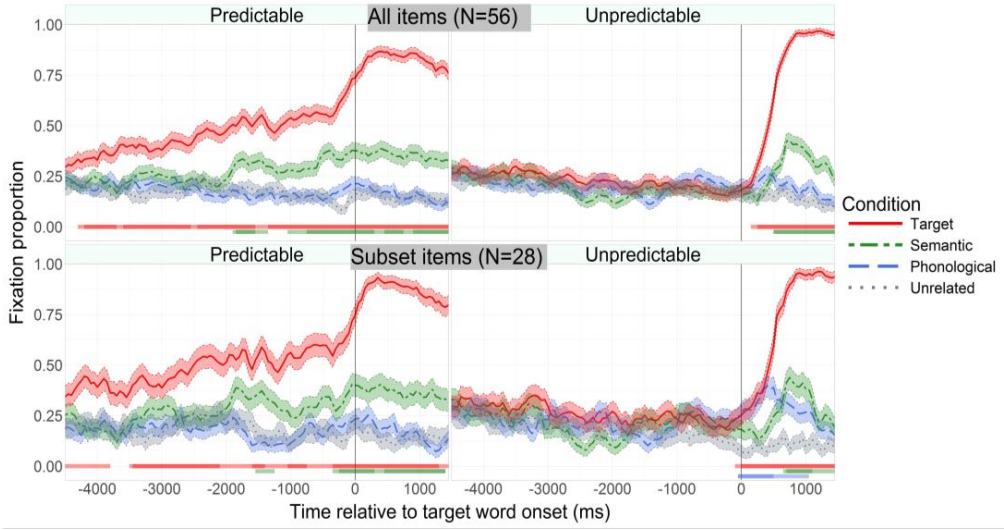


Figure. Fixation proportion in predictable (left) and unpredictable (right) sentences. The lines at the bottom of each plot indicate significant differences in a cluster based permutation analysis between target - unrelated (red), semantic competitor - unrelated (green), and phonological – unrelated (blue) conditions, corresponding to the time on x-axis.

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Tracking object-state representation in language comprehension: Does cognitive abilities matter?

Xin Kang, Ting Wang
The Chinese University of Hong Kong

The current study explores the time course of Mandarin speakers' retrieving and updating object-state representations and how individual differences in cognitive abilities are involved in this process. Eye-movements in the visual world paradigm were employed as indicator of the influence of linguistic structure on object-state representations (Altmann & Kamide, 1999).

28 native speakers of Mandarin Chinese listened to verb-final sentences depicting events of either a substantial change or a minimal change to the object-state whilst simultaneously viewed a visual display showing two target items (i.e. a broken vase and an intact vase) and two unrelated distractor items. Their working memory (digit span and reading span), visual memory (Continuous Visual Memory Test), fluid intelligence (TONI-4), and executive function (Tower of London) were also measured.

We found that object representation was updated at the offset of the verb. Correlation analysis further suggested that when a minimum change was described to occur on the object, looks towards the intended state was positively associated with fluid intelligence (r=.57, p=.006). Nonetheless, when a substantial change was described to happen on the object, working memory (r=.59, p=.004) was linked to looks towards the intended state. The results thus suggested that cognitive abilities play different roles in sentence processing depending on the language context. This is consistent with Fukuda et al. (2010) that working memory may be associated with the ability to maintain details of representations, while fluid intelligence is related to keep the number of items.

In sum, this study demonstrates that despite the immediate influence of linguistic information on how object-state is constructed in sentence processing, the success to update object representation also relies on cognitive abilities.

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The Effects of Second Language Proficiency on Novel Word Acquisition

Nina Kazanina and Laura Ayravainen

Background: Recent studies demonstrate a bilingual benefit in novel word acquisition (e.g. [1]). However, most studies operationalize word learning by explicit measures of memory, which leaves the extent of full lexicalization of newly learnt words unclear. The current study investigates word learning using the semantic priming and phonological competitor paradigms that tap into full lexicalization of novel words. Furthermore, learning a new phonological form and linking it to a meaning are explored separately. L2 experience might facilitate one or the other, or both of these aspects of novel word acquisition.

Method: Participants were native English speakers studying Spanish as an L2. They were divided into High (n=11) and Low (n=8) proficiency groups based on their Spanish word-nonword discrimination score. In **Session 1**, participants listened to English sentences that each contained a novel word (e.g. **cathedruke**). The meaning of each word could be inferred from the sentence context (e.g. "Adam changed the front brakes of his cathedruke yesterday", [cathedruke = bicycle], 6 different contexts were used per word). Subsequently, the participants completed Semantic Relatedness judgments (SR, see Table 1), Pause Detection (PD, see [2]) and Two Alternatives Forced Choice (2AFC, choosing the correct option from cathedruke vs cathedruce) tasks. Response times (RT) and -accuracy (RA) and target N400 amplitudes from SR task were used as indices of meaning acquisition of the novel words, whereas the behavioural data from the PD and 2AFC tasks were used as indices of the word form learning. In **Session 2** (48 h after Session 1) participants completed PD, 2AFC and SR tasks again. Performance in Session 2 is expected to show the lexicalization effects more clearly as they are known to take place after off-line consolidation (see [2]).

Results: In Session 1, preliminary ERP analysis showed a significant modulation of the target N400 amplitude by target type (related/unrelated) for all conditions (M, R, SA) approximately at the typical time window of 300-500 ms regardless of proficiency. In Session 2, the same pattern emerged for M (Figure 1) and R conditions, but only in High group for SA condition. With the current sample the RT data doesn't show effects of proficiency, apart from a numerically higher performance for High group.

Conclusion: The ERP result pattern suggests that L2 proficiency facilitates full lexicalization of novel word meanings.

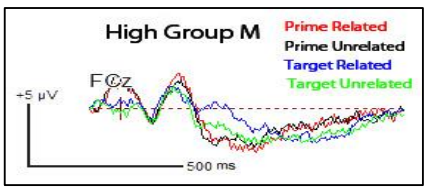


Figure 1. Session 2, grand average ERP response to the target, FCz, M condition, High group

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Condition	Prime	Related Target	Unrelated Target
Meaning (M)	cathedruke	bicycle	winter
Real (R)	bicycle	pedal	suite
Semantic Associate (SA)	cathedruke	pedal	suite

Table 1. A sample set of conditions from the SR task.

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Active formation of filler-gap dependencies is not accounted for by discourse prominence considerations

Maayan Keshev & Aya Meltzer-Asscher
Tel-Aviv University

Filler-gap dependencies are known to be formed actively during online sentence processing (e.g. Frazier, 1987; Stowe, 1986). This active strategy can be formulated in terms of pressure to syntactically license the filler, pressure to interpret as much of the sentence as possible (Altmann, 1999), or due to a preference for potential focus domains as extraction sites (Kuno, 1976). These interpretations differ with respect to the prospect of active dependency formation in non-extraction structures. The first would suggest no active interpretation strategy when syntactic dependencies are not involved, the second would suggest active prediction of any contextually relevant referent, and the last would suggest that such prediction would be implemented only in sentences that involve referents (fillers or not) that favour discourse-prominent slots. To test this, we investigated processing of several sentence types as in (1). These structures exhibit a hierarchy of possible antecedents, with a filler in (1a), a discourse-prominent antecedent in (1b), an antecedent which is not particularly prominent in (1c), and no antecedent in (1d).

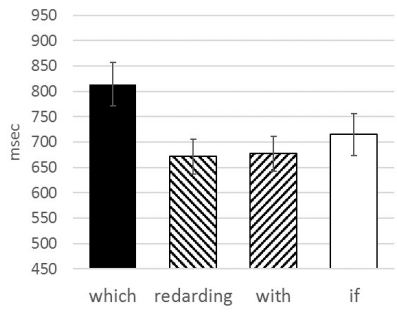
(1) a. The manager checked *which nurse* the patient persuaded…
b. The manager checked with regards to *the nurse* if the patient persuaded…
c. The manager checked with *the nurse* if the patient persuaded…
d. The manager checked if the patient persuaded…

A sentence completion experiment in Hebrew (N=28) revealed that participants tend to realize the complement of the verb with a referent provided in the sentence, using a pronoun or a gap corresponding to the antecedent, when this is possible. The highest proportion of such completions (95%) was observed in wh-questions (1a), with conditions (1b-c) also eliciting a high rate of such completions (69% and 70% correspondingly), all significantly higher than the rate of pronoun usage in (1d) (25%; all $p < .001$).

A self-paced reading experiment (N=37) with similar materials in Hebrew was designed using a filled-gap manipulation (by adding a continuation, e.g. "… the patient persuaded the doctors to curse"). The results contrasted with the completion data, revealing longer RTs on the filled-gap NP relative to the no-referend condition (1d) only in wh-questions (1a) ($p = .03$). RTs obtained in conditions (1b-c) were significantly lower than in wh-questions ($p = .009$; $p = .012$) and aligned with those in (1d) ($p = .98$; $p = .99$).

Results suggest that although maximal interpretation and/or pragmatic preferences for referring to discourse prominent antecedents play a role in comprehension/production (as revealed by the completion data), they do not underlie the active dependency formation observed in filler-gap dependencies. This supports syntactic licencing as the motivation for the active dependency formation strategy in filler-gap dependencies.

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RT at the filled-gap NP (SE)

Grammatical gender feature as a cue in L2 learners' reflexive resolution

Sanghee Kim[1], Jonghyeon Lee[1] & Jeong-Ah Shin[2]
1 Seoul National University
2 Dongguk University

L2 learners would wrongly identify *she* as the antecedent of *herself* in "She read that the wrestler had trained herself to run longer." Such erroneous resolution was attributed to L2ers' high sensitivity to the discourse prominent entity (e.g., subjecthood, c-commanding) [1]. However, given that a singular pronoun has a grammatical gender feature specified within its lexical entry while a proper noun does not [2], what is claimed to be the discourse prominence effect may be confounded by the influence of grammatical gender feature.

We conducted four self-paced reading tasks with natives (Expt.1, n=32; Expt.2, n=32) and Korean L2ers (Expt.3, n=29; Expt.4, n=34). An item had a context sentence and a target sentence (1). The discourse prominent entity was manipulated by its grammatical gender feature: a pronoun (Expt.1 & 3) and a proper noun (Expt. 2 & 4). We varied the embedded subject by stereotypical gender. The conditions differed by gender (mis)match with the embedded subject: (a) discourse prominent entity (match/mismatch), and (b) reflexive pronoun (match/mismatch).

For the native group, a main effect was found only in the reflexive pronoun and not in the discourse prominent entity for both experiments. The results show that the natives mainly abide by the structural constraint [3,4]. However, the L2 group was different. In Expt.3, the main effect of the discourse prominent entity was observed along with the late main effect for the reflexive pronoun. In contrast, in Expt.4, a main effect was found only in the reflexive pronoun and not in the discourse prominent entity. The mitigated sensitivity to the discourse prominent entity can be taken as the influence of grammatical gender feature [5].

These findings suggest that grammatical gender feature is influential in L2ers' reflexive resolution on top of the learners' high awareness of discourse prominent information. The result can be interpreted under the framework of cue-based memory retrieval [6], and shows that memory retrieval can even account for L2 learners' reflexive resolution [7].

1a. **He$_{M}$/She$_{MM}$** read that the wrestler had trained / himself$_{M}$/herself$_{MM}$ / to / run / longer.
1b. **James$_{M}$/Helen$_{MM}$** read that the wrestler had trained / himself$_{M}$/herself$_{MM}$ / to / run / longer.

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Facial Expressions and Phonetic Recalibration in Speech Perception

Seung Kyung Kim [a], Sunwoo Jeong [b], James Sneed German [a]
[a] Aix-Marseille Univ, CNRS, LPL, Aix-en-Provence, France; [b] Stanford University, CA, USA

Listeners can adjust and recalibrate their phonetic boundaries based on exposure to new speech input (Norris et al., 2003). In this study, we investigate whether social factors external to the speech signal during exposure can affect this phonetic recalibration. Specifically, we test whether phonetic recalibration is modulated by the facial expression of the speaker. Existing studies show that speech production and perception are dynamically sensitive to social characteristics of the speaker (Niedzielski, 1997; Johnson et al., 1999; Babel 2012, i.a.), but it has not been studied whether perceptual learning (i.e., phonetic recalibration) is similarly sensitive to social factors.

During a training phase, participants were presented auditorily with (i) 60 words with a word-medial /d/ (e.g., *academia*), (ii) 60 with a word-medial /t/ (e.g., *politician*), and (iii) 60 filler words containing neither /d/ nor /t/. An additional set of 180 non-word fillers contained neither /d/ nor /t/. The auditory material was produced by a female native speaker of American English. The task of the participants was to make a lexical decision for the 360 spoken words and non-words. Crucially, the /t/ sounds in the t-words were carefully manipulated – in particular, by shortening VOT and closure length – to be ambiguous between /t/ and /d/, and this manipulation was verified in a separate norming study. The /d/ sounds were not manipulated. During this training phase, a picture of a woman was presented on the screen. In one between-subjects condition (Smile), the woman was smiling; in the other condition (No Smile), the same woman was not smiling. After the training phase, the participants performed a categorization task for tokens on an 11-step /ata/-/ada/ continuum to assess whether their category boundary between /t/ and /d/ had shifted. Since the /t/ sounds in the training are closer to /d/ than usual, if perceptual learning occurs, the category boundary should shift towards the /d/-end of the continuum.

Results from 18 female participants are shown in Figure 1. (Data collection is ongoing and the study will include a total of 32 female and 32 male participants.) Listeners in the No Smile condition showed a positive effect of perceptual learning, in that they tended to choose /t/ more often for higher continuum steps than a control group did ($z = 1.9$, $p = 0.06$), shifting the category boundary to the /d/-end. (The baseline was obtained from a separate group of female participants who did not undergo training.) Listeners in the Smile condition, on the other hand, showed no evidence for perceptual learning ($z = -0.9$, $p = 0.4$).

This finding is somewhat counter to studies on learning that report better learning outcomes with more attractive or likable instructors (Westfall et al., 2016), though Babel (2012) shows that greater likeability and attractiveness can sometimes result in reduced phonetic imitation. The current study provides a novel finding that phonetic recalibration is affected by speech-external social factors, though more research is needed to understand the role of specific facial expressions.

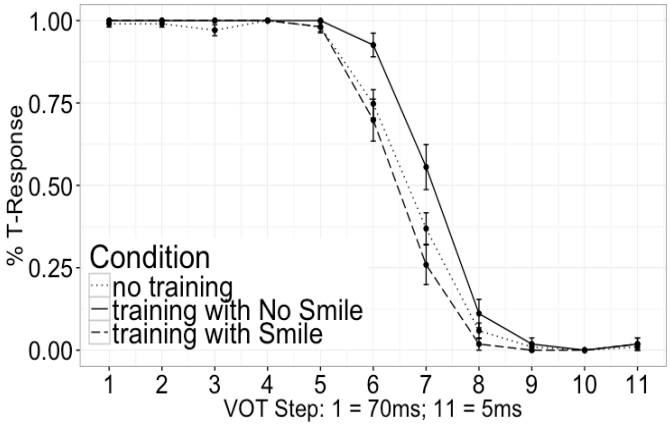


Figure 1. Preliminary results of the post-training categorization on an /ata/-/ada/ continuum

Language-Wide Inhibition Accumulates Over Time

Daniel Kleinman (UIUC) & Tamar H. Gollan (UC San Diego)
dgk@illinois.edu

Bilinguals rarely use the wrong language by mistake. To explain this feat, Green (1998) proposed a widely cited model of bilingual language control with two forms of inhibition: An English-dominant bilingual naming a picture of a cat in Spanish (*gato*) exerts *reactive inhibition* so that *gato* inhibits its translation *cat* (though evidence for this is largely lacking, with many production studies suggesting translation *facilitation*), as well as *global inhibition* of the English lexicon which must be lifted before the bilingual speaks English.

We investigated how these forms of inhibition evolve over time in a meta-analysis of cued language-switching experiments. When repeatedly naming a small set of pictures, bilinguals might be affected by **(a) same-language repetition:** the # of times the picture was previously named in the same language (repetition priming → faster RTs); **(b) different-language repetition:** the # of times the picture was named in the other language (reactive inhibition → slower RTs); and **(c) the duration of language mixing:** the # of times different pictures were named. If global inhibition builds up rather than switching completely on/off, (c) → slower RTs especially for the dominant language.

In our experiments, 416 Spanish-English bilinguals named 9 pictures 12 times each in a cued switching block in which language cues appeared 250 ms before the picture. To separately index the influence of different cognitive mechanisms on naming times, we decomposed trial number (range=1-108) into the three factors listed above. (These factors were separable due to variability in the delays between successive repetitions of each picture.) Using mixed-effects models with maximal random effects by subjects and items, we assessed the influence of each factor on naming RTs, as well as its interaction with Language (Dominant/Non-Dominant, determined for each subject via a proficiency test).

The model detected separable effects for each trial number component: (a) Bilinguals named pictures 64 ms faster for each doubling in how often they had previously named the same picture in the same language (p<.01), an effect that was 23 ms larger for the non-dominant language (p<.01), replicating Francis et al. (2003); (b) 10 ms slower for each time they had named the same picture in the other language (p<.01), indicating reactive inhibition that was equivalent for both languages (interaction: B=1, p=.60); and (c) 0.79 ms slower for each time they had named a different picture (p<.01), an effect that was 0.59 ms larger for the dominant language (p<.01) but significant for both languages (both ps<.01).

These data reveal the simultaneous influence of multiple dissociable control mechanisms during language switching. While inhibition between translations accumulates symmetrically, the dominant language is globally suppressed more and more over time.

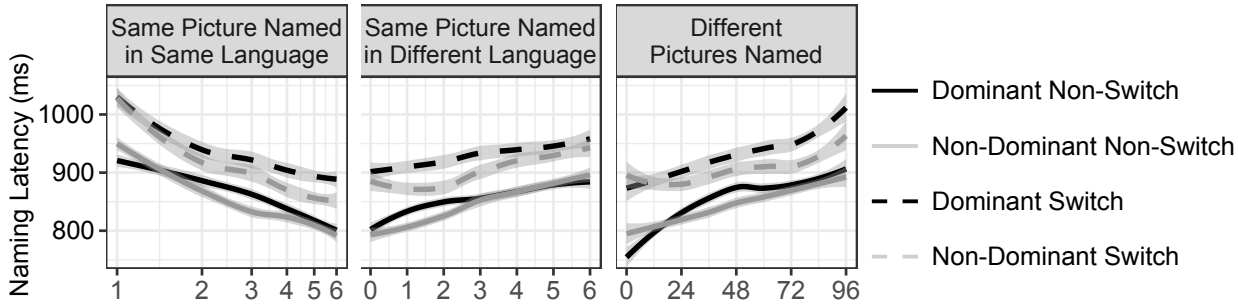


Figure. Picture naming latencies for each language and switch condition. For visualization only, RTs are LOESS-smoothed and the figure for each trial number component holds the other two components constant at their mean (statistically, all components were modeled simultaneously). Same-picture same-language repetition is depicted on a log scale (base 2) to reflect analyses. Ribbons = 95% CIs.

On the relationship between eye movements and the N400 in predictive actor processing: A unifying statistical approach

Franziska Kretzschmar[1], Phillip M. Alday[2,3]
1 University of Cologne, Cologne, Germany, 2 University of South Australia, Adelaide, Australia, 3 MPI for Psycholinguistics, Nijmegen, The Netherlands

Predictions for prototypical actor arguments are known to influence sentence comprehension across varying languages. For instance, unexpected atypical actors (e.g., inanimates) typically induce larger amplitudes in the N400 event-related potential (ERP) (e.g., Weckerly & Kutas 1999; Muralikrishnan et al. 2015). Atypical actors also prolong reading times as measured with various fixation time measures in natural reading (e.g., Betancort et al. 2009; Mak et al. 2002). From a domain-general perspective, the common basis of N400 and eye movements may be prediction error and the ensuing need to revise one's internal representation of the current sentence meaning (cf. Bornkessel-Schlesewsky et al. 2016; Friston et al. 2012). This view bears implications for the correspondence between both measures in sentence reading as it posits that N400 and eye movements correlate only if they follow the same prediction error, without targeting a particular eye movement measure. This contrasts with assumptions that link specific ERPs and eye movement measures via some linguistic subdomain (e.g., semantic variables invariably affect N400 and first-pass time). To test this hypothesis, we re-analysed data from an eye-movement study (N=84) and an ERP study (N=37) in German that investigated animacy-based predictions of actor prototypicality with identical stimuli (see example stimuli below). Actor prototypicality was varied by noun animacy (animate vs. inanimate) and verb bias towards an animate (e.g., *to hop*) or inanimate actor (e.g., *to roll*). Both factors were fully crossed and combined with a three-level word-order manipulation (preverbal actor NP [1] vs. preverbal directional PP [2] vs. preverbal expletive [3]).

Example stimuli
1. *Ein Junge/Stein hüpft/kullert über die Wiese, während die Vögel in den Bäumen zwitschern.*
   'A boy/stone hops/rolls over the meadow, while the birds are chirping in the trees.'
2. *Über die Wiese hüpft/kullert ein Junge/Stein, während …*
   Over the meadow hops/rolls a boy/stone, while ...
3. *Es hüpft/rollt ein Junge/Stein über die Wiese, während …*
   There hops/rolls a boy/stone over the meadow, while …

Both experiments replicated previous results by revealing larger N400 amplitudes and longer go-past time for unexpected atypical actors and nil effects for first-pass time (cf. Kretzschmar et al. 2016). To assess whether the two fixation measures and N400 correlate, we aggregated one measure across participants to provide a numeric predictor for the other with mixed-effects models. Notably, the two participant groups do not overlap. Overall, the "design" models with experimental manipulations provided the best model fits. For modelling the ERP data, aggregate go-past time provided a better model fit than aggregate first-pass time. For modelling the eye-tracking data, both design and aggregate N400 responses were better able to model go-past time than first-pass time. Thus, this method quantifies the relationship between eye movements and electrophysiology and thereby supports the domain-general perspective postulating that ERPs, especially the N400, and reading times are correlated if they result from similar prediction error.

Ordering adjectives for communicative efficiency in English and Basque

Kumiko Fukumura (University of Strathclyde) & Mikel Santesteban (University of the Basque Country)

kumiko.fukumura@strath.ac.uk

When producing multiple adjectives, speakers do not order them randomly. Whereas much research has focused on semantic constraints on adjective ordering (e.g., Scontras et al., 2017), little attention has been paid to communicative constraints. Here, we examined (1) whether adjective ordering is affected by speakers' effort to facilitate early referent identification and (2) if so, what representation might underlie such effect.

Danks and Glucksberg (1971) proposed that English speakers' preference for size-before-color (*large red car)* over color-before-size orders (*red large car*) is due to a pragmatic constraint: Size is more informative for discriminating referential alternatives than color, and speakers generally order more discriminating adjectives before less discriminating ones in English. However, research in English and German has failed to find evidence that speakers order size and color adjectives for discriminability (Belke, 2001; Danks & Schwenk, 1972). Investigating the ordering of color and pattern modifiers in English, Haywood, Pickering and Branigan (2003) also found that communicative helpfulness does not reliably influence adjective ordering.

In a referential communication task, we focused on the impact of contextual discriminability on the ordering of color and pattern modifiers in English (Exp 1) and Basque (Exp 2). Speakers referred to one of four similar objects when their addressee had to identify the referent. In the *color-relevant* context, color discriminated the target from the rest, whereas in the *pattern-relevant* context, pattern was discriminating. In the *both-relevant* context, the combination of color and pattern identified the object. The *hierarchical modification* hypothesis (Danks & Glucksberg, 1971) assumes that speakers preferentially order more discriminating adjectives closer to the head noun; the more discriminating the adjective is, the further from the noun it is to modify the less discriminating adjective and the noun. Hence, more discriminating adjectives should precede less discriminating ones in English, where the modifiers precede the head noun, whereas the opposite should be the case in Basque, where the head noun precedes the modifiers. Alternatively, the *linear modification* hypothesis predicts that contextual discriminability affects the linear ordering of the adjectives to facilitate early referent identification; speakers of both languages should produce more discriminative adjectives before less discriminative ones.

Experiment 1 showed that English speakers favored pattern-before-color (PCN) orders (*stripy green bow*) (relative to color-before-pattern, CPN, orders) significantly more in the pattern-relevant than in the color-relevant context, and they also produced PCN orders significantly more often in the both-relevant than color-relevant context. Importantly, Experiment 2 showed that Basque speakers also favored pattern-before-color orders (NPC orders relative to NCP orders) more in the pattern-relevant than in the color-relevant context and in the both-relevant context. Hence, both English and Basque speakers produced more discriminating adjectives before less discriminating ones, providing support for the linear modification hypothesis. Additionally, both English and Basque speakers overspecified color significantly more often than pattern and they generally favored color-before-pattern orders than pattern-before-color orders, indicating that color was more available than pattern, and the more available the adjective was, the earlier it occurred.

Our results thus provided first cross-linguistic evidence that contextual discriminability affects adjective ordering; speakers produce more discriminatory adjectives in an early surface position to facilitate early referent facilitation.

An Investigation into Audio Perception Studies on Amazon Mechanical Turk

Crystal Lee, Lauren Oey, Emily Simon, Xin Xie, T. Florian Jaeger, University of Rochester

Amazon Mechanical Turk (MTurk) has been widely-used among the social sciences as a fast, convenient way to recruit participants among a large subject pool. Indeed, studies from different fields examining topics such as syntactic judgements and low-level visual tasks have validated MTurk as a reliable way to obtain data[2,3]. Here, we examine this web-based platform's methodological functionality for audio-based experiments. We sought to replicate a study examining cross-talker generalization on MTurk[1]. In particular, we conducted two versions of the same experiment, one through Amazon Mechanical Turk and one in laboratory settings, to explore whether the environment of the experiment (online vs. in-lab) would influence the generalization effect. Crucially, the sample size of the in-lab study was the same as the original study[1] and was tripled in the MTurk study.

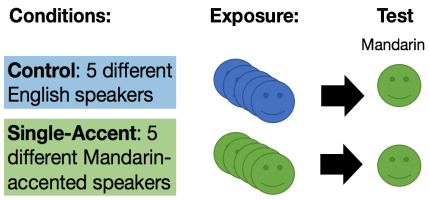


Figure 1. Experimental design.

Methods & Results: The experiments had an exposure phase that presented either five Mandarin-accented (Single-Accent) or native English speakers (Control), and then tested listeners on a novel Mandarin-accented speaker in a sentence transcription task (Fig.1). For in-lab sessions, external factors such as audio equipment and volume were controlled; only MTurk participants who used in-ear or over-ear earphones (based on self-reports) were included. Contrary to past findings[1], we find no significant difference between Single-Accent and Control conditions in either experiment (Fig.2), although in-lab performance was higher overall ($p < .001$).

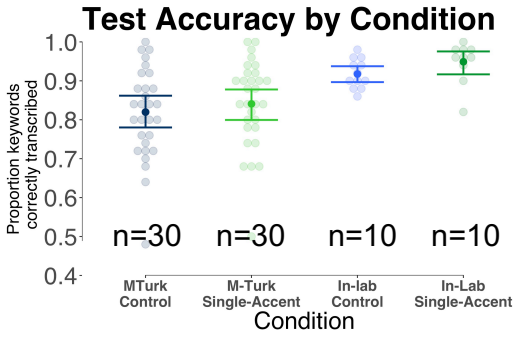


Figure 3. Results on Mandarin-accented Test speaker.

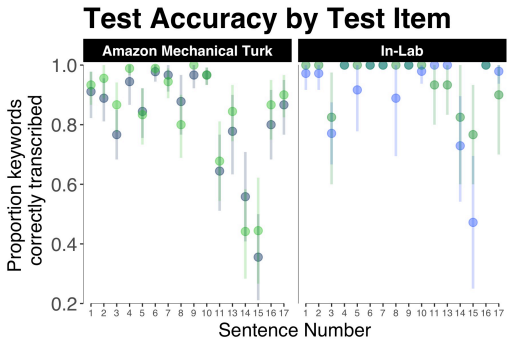


Figure 2. Average performance on each Test sentence.

Cross-platform Comparison: We conducted in-depth analyses of potential causal factors that may lead to a lower performance and greater variability among MTurk subjects. Time of day, time spent in experiment, gender, and age were not significant factors. However, by-item analysis revealed similar performance across experiments, suggesting reliability of our data regardless of testing environment (Fig.3).

Conclusion: Across two experimental environments, we did not find evidence in support of a strong generalization effect[1], although both online and in-lab participants showed a trend in the predicted direction. The highly similar behavioural patterns across testing platforms validated the use of web-based studies in audio-based research, with the caveat that such studies should have a large effect size and sample size to combat greater variability between subjects. Our results suggest that the cross-talker generalization effect is not as robust as previously thought. Future experiments should consider potential extraneous factors that may influence results.

[1]Bradlow & Bent, *Cognition*, 2008; [2]Crump et al., *PloS*, 2013; [3]Sprouse, *Behav Res*, 2011.

The Time-course of Reflexive Binding in Korean:
Behavioural and Neurophysiological Evidence

Sun-Young Lee[1], Jihye Suh[1], Yunju Nam[2], Dongsu Lee[2], Haegwon Jeong[3]
([1]Cyber Hankuk University of Foreign Studies,
[2]Konkuk University, [3] Hankuk University of Foreign Studies)

This study investigated the processing of the Korean reflexive *caki* based on the data from an ERP study using a picture-sentence verification task. In English, a reflexive should be locally bound by its antecedent whereas it can be bound either by a local antecedent or a long-distance antecedent in languages like Korean (Chomsky, 1986). For example, in an English example shown below in (1), *himself* can refer only to *Bill*, the local antecedent, but not to *John*, the long-distance antecedent. On the other hand, in a Korean example shown in (2), *caki* can refer either to *Bill* or to *John*.

(1) English -*self*
John$_i$ thinks that [Bill$_j$ likes himself$_{*i/j}$]

(2) Korean *caki*
John$_i$-un [Bill$_j$-i caki$_{i/j}$-lul cohaha-n-ta]-ko sayngkakha-n-ta.
John-TOP [Bill-NOM self-ACC like-PRE-DEC]-COMP think-PRE-DEC.

Various types of behavioural studies proved the different binding domains of the reflexives between English and Korean. In particular, Korean speakers preferred long distance binding relations to local binding relations when they interpreted *caki* (e.g., Lee S-Y.2017 98% vs. 43%). Recently, new types of data have been collected from the neurophysiological perspective. For example, violations of binding relations with English reflexive elicited P600, which was taken as evidence for the claim that binding principles is psychologically real syntactic phenomena (Harris 2000). In this study, we investigate the binding relations in Korean using ERPs focusing on *caki* to seek crosslinguistic evidence from the typological perspective. It is plausible to find no difference between the two types of relations in Korean in the ERPs since both of them are *syntactically possible* interpretations even though long distance binding relation is *preferred* to local binding. We compared behavioural data and ERPs data to find any differences between the local and long distance binding relations of Korean reflexive *caki.* A picture-sentence verification task was used with auditory stimuli in order to reflect clear binding relations in the interpretations.

EEG data were collected from 20 Korean native speakers along with their judgement data in the picture-sentence match/mismatch task. First, the behavioural data revealed that long-distance binding relations took longer to process than local binding relations, even though the former was accepted more frequently than the latter (93% vs. 60%). Secondly, however, our ERP data showed no difference between long distance binding and local binding relations at the time of '*caki*' even though N400 was found at the time of verb (c.f., Korean is a verb-final language) in the mismatched conditions. The behavioural data provide empirical evidence for the *asymmetrical complexity* of structural relations between reflexives and their antecedents in long-distance vs. local binding interpretations. On the other hand, ERP data can be taken as neurophysiological evidence for the two *syntactically possible* binding relations of *caki* at the time of parsing it even though it is interpreted as long distance binding at the end of the sentence.

Does Information Theory constrain the usage of fragments? - An experimental study

Robin Lemke, Lisa Schäfer & Ingo Reich (CRC 1002, Saarland University)

{robin.lemke|lisa.schaefer}@uni-saarland.de, i.reich@mx.uni-saarland.de

Speakers frequently use fragments (1a) (Morgan 1973) to communicate the same message as they would with full sentences (1b). Given that both fulfill the same function, why do people choose to use one or the other in a specific situation, as a train journey in (1)?

(1) a. [Conductor to passenger:] "Your ticket, please."
b. [Conductor to passenger:] "Show me your ticket, please."

We pursue the hypothesis that speakers choose the encoding that is more optimal w.r.t the information-theoretic principle of Uniform Information Density (UID, Levy & Jaeger 2007). According to UID, information, which is defined as $-\log_2$ p(word|context)(Shannon 1948), tends towards being distributed uniformly across the utterance. UID predicts a preference for fragments if parts of the sentence are uninformative, i.e. highly predictable, and omitting them yields a more uniform distribution. This holds in (1), but not in the unpredictable (2).

(2) a. "Your suitcase, please."
b. "Put your suitcase in the overhead compartment, please."

We used an acceptability rating study comparing (un)predictable utterances as (1a,b),(2a,b) in a 2×2 design (`Sententiality` × `Predictability`). In order to get empirically motivated estimates of probability, we based our materials on DeScript (Wanzare et al. 2016), a crowd-sourced corpus of script knowledge which contains 100 individual descriptions for each of 40 scenarios. Following Manshadi et al. (2008) we extracted chains of events (verb and object) from the data and calculated event probabilities with bigram language models. Our items consisted of an introductory sentence followed by a sequence of three script events and the target utterance, which is predictable (1) or unrelated to the script (2).

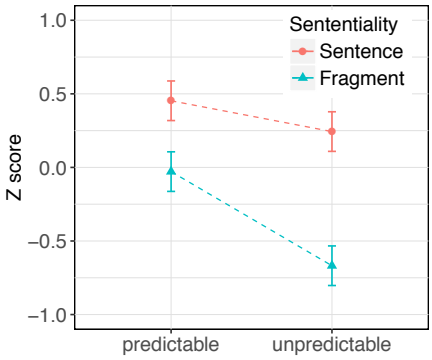


Figure 1 Normalized ratings, 95% CIs.

48 subjects rated the naturalness of the target utterance for 24 items on a 7-point Likert scale (7 = completely natural). See fig. 1 for an overview of the data. Besides significant main effects of both IVs, the Cumulative Link Mixed Models (R, package `ordinal`) reveal a significant interaction between them ($|z| = 2.97, p < .01$). The observation that fragments are specifically degraded in the unpredictable condition supports our hypothesis.

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In Search of an Ambiguity Advantage in the Processing of Pre-Nominal RCs

Pavel Logačev (Bogazici University, Turkey), Müge Tunçer (Anadolu University, Turkey)
pavel.logacev@boun.edu.tr

Traxler et al. (1998) found that ambiguous sentences are sometimes read faster than their unambiguous counterparts. Readers speed up during the reading of sentences like (1) when the relative clause (RC) can attach to either noun phrase (NP), compared to when attachment is unambiguous.

(1) The maid/son of the princess [who scratched herself/himself in public]$_{RC}$ was terribly humiliated.

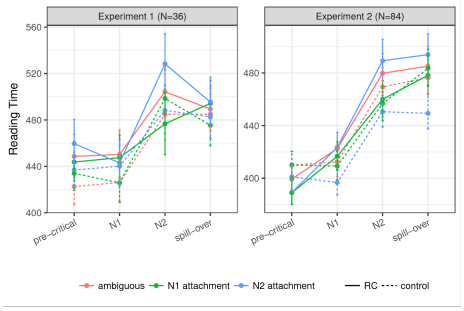
There are currently three classes of accounts of this so-called *ambiguity advantage*: **Race-based models** (Van Gompel et al., 2001; Logacev & Vasishth, 2016) assume a race between two co-active processes which search for an attachment site for the RC and terminate the search as soon as one of them completes the attachment. The result is an increase of the probability of fast completion, compared to unambiguous conditions. **Surprisal** (Levy, 2008) assumes that processing difficulty is caused by disconfirmation of potential parses, as a result of disambiguation. Ambiguous sentences do not involve disambiguation. Finally, **underspecification** accounts (Swets et al., 2008) assume that readers can underspecify RC attachment when disambiguation is not required.

All models predict an ambiguity advantage in structures with *post-nominal RCs*, because in incremental processing, both potential attachment sites are available when the RC is encountered. In structures with pre-nominal RCs, however, such as in Turkish (2), potential attachment sites become available one by one, after the RC has been processed. Therefore, race-based models predict a negligible or no ambiguity advantage since attachment to the first NP can begin before the second NP is encountered. Surprisal and underspecification, however, predict an ambiguity advantage irrespective of RC position.

(2) Dün, [birbirini döven]$_{RC}$ [[futbolcu-ların/-nun] hayran-ları/-ı] stadyumu terk etti.
Yesterday, each other hit football player-PL.GEN/-SG..GEN fan-PL.POSS/-SG.POSS stadium leave did.

'The fans of the football players who hit each other left the stadium, yesterday.'

We present the results of two self-paced reading experiments in Turkish designed to address this issue. The 6 experimental conditions in both experiments were modelled after sentence (2), in which a pre-nominal subject RC containing the reciprocal *each other* preceded a complex NP consisting of two nouns. We controlled the availability of attachment sites by manipulating the grammatical number of the two nouns, resulting in three attachment conditions: N1, N2, and ambiguous. To control for the differences in meaning and length, we created three control conditions by replacing RCs with adjectives. In Experiment 1, participants answered occasional superficial questions, only in filler sentences in order to encourage strategic underspecification. In Experiment 2, questions about RC attachment were asked on every trial.



The figure on the left shows the average RTs at the critical regions. Bayesian linear mixed-effects models showed a slowdown in N2 attachment conditions at N2, relative to N1 attachment conditions (exp. 1: CI= [-10ms; 110ms], P(β>0)=.96; exp. 2: CI=[6ms; 67ms], P(β>0)=.99). We found no indication of a substantial ambiguity advantage (faster reading in ambiguous conditions) in exp. 1 (CI=[-18ms; 82ms], P(β>0)=.89) and exp. 2 (CI=[-22ms; 36ms], P(β>0) = .7).

A small social effect on a big automatic priming effect

Janine Lüthi, Marie-Anne Morand, Constanze Vorwerg (University of Bern)

Syntactic priming is considered to be an effect of automatic post-conscious processes, and part of linguistic alignment in dialogue (e.g., Pickering & Garrod, 2004). Only few studies have examined the impact of conversational and social factors on syntactic priming (cf. Segaert & Hagoort, 2016). Especially with regard to the influence of speaker likeability, they have revealed inconclusive or inconsistent results (Balcetis & Dale, 2005; Lev-Ari, 2015). This study sets out to tackle the issue again of whether likeability affects syntactic priming, using both experimental control on likeability, and pre-tested materials.

We tested priming of ditransitive structures in a picture-description task with a confederate, whose likeability was manipulated by means of scripted answers to a profile sheet that participants exchanged prior to the experiment, and her overall behaviour. Experiment 1 tested priming within Bernese German (a Swiss-German dialect). Experiment 2 tested priming between Standard and Bernese German, to examine whether the potential effect holds across varieties. Each experiment was conducted with 32 participants, half of which were paired with either the likeable or the dislikeable confederate.

The likeability manipulation was successful: Participants' ratings for the disagreeably presented confederate were significantly smaller than those for the other one in both experiments (Exp. 1: $M_{likeable}$=6.9, $M_{dislikeable}$=4.08, $t(17)$=-8.61, p<.001; Exp. 2: $M_{likeable}$= 6.88, $M_{dislikeable}$=3.85, $t(17)$=-9.43, p<.001). We found a significant priming effect with 72.3% primed responses in Experiment 1 (*Estimate*=-1.56, *SE*=0.33, *z*=-4.73, *p*<.001) and 69.5% in Experiment 2 (*Estimate*=-1.12, *SE*=0.22, *z*=-5.09, *p*<.001). There was a main effect of likeability, with significantly more primed responses when the participants completed the task with the likeable confederate (78.2%) than with the dislikeable confederate (66.3%) when priming within Bernese German (*Estimate*=-1.27, *SE*=0.46, *z*=-2.75, *p*=.006). In contrast, there was no effect of likeability when priming between Standard German and Bernese German (67.8% vs. 71.2%, *Estimate*=0.13, *SE*=0.31, *z*=0.31, *p*=.668).

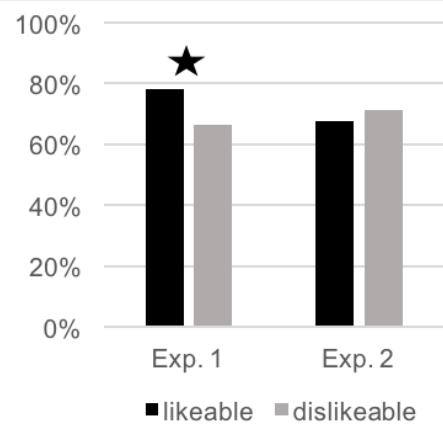


Figure 1. Primed responses in both likeability conditions

The strong overall priming effects support an automatic account of syntactic priming, suggesting the occurrence of syntactic priming independent of the social context. However, the findings further indicate a social modulation of syntactic priming, presenting the first unequivocal evidence for an effect of likeability on the magnitude of syntactic priming. Yet, it is a minor effect, which may or may not play a role depending on the overall context and on other, interacting factors.

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Modelling chunking in online speech processing

Anna Mauranen and Svetlana Vetchinnikova, University of Helsinki

Both linguists and cognitive scientists have suggested that speech is processed in chunks (Sinclair ,1996; Ellis, 2003; Christiansen & Chater, 2016; Giraud & Poeppel, 2012). The composition and boundaries of such chunks are influenced by top-down as well as bottom-up processing. As a result, chunks emerge in the interaction of cognitive, linguistic and physical factors.

Traditional models of language description do not take linearity of processing into account. Some more recent grammatical models attempted to take a more incremental view (Brazil, 1995; Kempson et al., 2001; G. O'Grady, 2010). *Linear Unit Grammar* (LUG) proposed by Sinclair and Mauranen (2006; see also Mauranen, 2012, 2016) goes further and develops a system of analysis where the first step involves intuitively assigned chunk boundaries. The model bridges the gap between speech as it is experienced and the systematic description of language.

To test the cognitive reality of chunking and the predictions of the model, we conducted an experiment where participants were asked to listen to short audio clips of natural language while following them from transcripts. The task was to mark boundaries between chunks during listening and put a boundary where they felt a chunk ended. The task was designed as a web-based application for tablets *ChunkitApp*.

The findings show the overall distribution of boundary markings and the agreement on boundary/no boundary across participants support the validity of the construct of online chunking and its operationalization in ChunkitApp (Vetchinnikova et al. forthcoming). Boundaries marked by experiment participants correlate with the LUG model (r_{pb}= +.60; two-tailed p= <.0001). There is complete agreement on no boundary in 65% of potential boundary places between participant marking and the model; in 22% there is agreement on a boundary. Most discrepancies occur where LUG predicts a boundary the participants ignore in cases involving minor elements like hesitations or conjunctions. Unpredicted markings account for merely 3% of cases.

Based on these results, we conclude that the model has cognitive validity.

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Individual Differences in Chunking Ability Predict Sentence Processing at Multiple Levels of Abstraction

Stewart M. McCauley (Univ. Liverpool), Erin Isbilen, Morten H. Christiansen (Cornell Univ.)
Stewart.McCauley@liverpool.ac.uk

According to a recent theoretical proposal (Christiansen & Chater, *BBS* 2016), the fleeting nature of the sensory signal—and the limits of human memory for it—necessitate "chunk-and-pass" processing: language users must rapidly chunk the input into manageable units and pass them to increasingly higher levels of abstraction, before they are overwritten by new incoming information. Crucially, chunking takes place at each new level. Here, we show that chunking shapes sentence processing at multiple levels of abstraction.

Prior to a self-paced reading task, participants engaged in two "pre-tests" to assess chunking at separate levels. In the first, which assessed word chunking ability, participants were tasked with recalling strings of 12 individual words, with each string consisting of 4 separate word trigrams extracted from a large corpus of English. Importantly, to recall more than a few discrete items (4±1; Cowan, *BBS* 2001), listeners must chunk the words of the input sequence into larger, multiword units. We expected them to draw upon linguistic experience with the trigrams. Moreover, we included matched randomized control strings as a baseline performance measure. Comparing recall for experimental and control trials provides a *word chunk sensitivity* score that reflects language chunking experience while controlling for such factors as attention, motivation, and working memory.

The second pre-test followed the same logic to assess phonological chunking ability. It consisted of a non-word repetition task, designed such that the same set of syllables occurred in two different non-words, but in different orderings: one that yielded an item with high "chunkability," according to corpus statistics, while the other was estimated to be less "chunk-like." This allowed us to calculate an individual's *phonological chunk sensitivity* score as the difference in performance between the two conditions.

Subjects also participated in a self-paced reading task to determine the extent to which performance on the pre-tests predicted individual differences in specific aspects of sentence processing. It featured 1) object-relative clauses with low-level phonological overlap (which has been shown to interfere with processing; Acheson & MacDonald, *JML* 2011); and 2) sentences with long-distance subject-verb number agreement and locally distracting number-marked nouns (Pearlmutter, Garnsey, & Bock, *JML* 1999).

Crucially, in each pre-test subjects must utilize chunking to remember more than a few items (cf. Cowan, *BBS* 2001). For the difference between sentences featuring locally distracting number information and their control counterparts, we found that *word chunk sensitivity* was a significant predictor of RT difference at the verb (β=-0.79, t=-3.19, p<0.01), while *phonological chunk sensitivity* and the interaction term did not reach significance. With regard to the difference between OR sentences with and without phonological overlap, we found that *phonological chunk sensitivity* was a significant predictor of RT differences at the main verb (β=-3.49, t=-2.43, p<0.05), while *word chunk sensitivity* and the interaction term did not reach significance. Moreover, there was no correlation between *phonological chunk sensitivity* and *word chunk sensitivity* scores.

Thus, we show that individual differences in chunking ability predict on-line sentence processing at multiple levels of abstraction: chunking at the phonological level predicts the way phonological information is used during complex sentence processing, while chunking at the multiword level predicts the ease with which long-distance dependencies are processed in the face of conflicting local syntactic information.

Is he a book? Animacy restrictions of the overt pronoun in European Portuguese

Sara Morgado[1], Maria Lobo[1], Paula Luegi[2]
[1]CLUNL/FCSH-Universidade NOVA de Lisboa
[2]Universidade de Lisboa - Centro de Linguística da Universidade de Lisboa

Like other null-subject languages, European Portuguese (EP) has two types of subject pronouns (null and overt pronouns) that differ in their preferences to retrieve antecedents. Several studies have shown different syntactic and semantic biases for each pronominal form, either in EP or in other null-subject languages. The findings have been explained by the Antecedent Position Hypothesis (Carminati, 2002), (APH): the null pronoun prefers an antecedent in the Spec IP position while the overt pronoun prefers an antecedent in other syntactic positions. However, other properties that may constrain the interpretation of the pronouns have received less attention in the literature. One of those is the animacy of the antecedents. Unlike English, EP does not have a specific pronoun for inanimate entities and both pronominal forms can, theoretically, retrieve them. Yet, Cardinaletti & Starke (1999) notice a semantic difference between overt (strong) and null pronouns: null pronouns, unlike strong pronouns, are not semantically constrained for human or animate features. A corpus study (Barbosa, Duarte & Kato, 2005) also shows that in EP, unlike Brazilian Portuguese (BP), the overt pronoun tends to recover only animate antecedents.

This semantic effect, however, has not been investigated systematically with EP speakers. To test whether the overt pronoun is sensitive to the animacy of the antecedent, we used a moving window self-paced reading task with 26 undergraduate students reading 24 complex sentences initiated by a subordinate clause with subject (always animate) and object (either animate or inanimate) antecedents. In the matrix clause, the overt pronoun retrieved unambiguously (by gender agreement) the antecedent in object position, its preferable antecedent according to the APH. A yes/no comprehension question always followed, retrieving the object antecedent. Reading times were recorded for all regions, including the comprehension question, using *PschoPy* software. Accuracy of answer was also recorded. Reading times on the pronoun region were analysed by fitting a linear-mixed effects models using the *lmer* function from the *lme4* package in *R*. We found a significant effect (β= 0.92; *SE*= 0.37; *t*=2.46; *p=.01*) when the overt pronoun was forced to retrieve the inanimate antecedent and this was in the expected direction: slower reading times for inanimate antecedents.

We conclude the observed effect is due to animacy restrictions of the overt pronoun. This effect is in line with the assumption that EP has strong pronouns and that they favour animate antecedents.

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When an unstoppable LAD meets an impossible object: Tracking the developmental stages of copredication

Elliot Murphy, Division of Psychology and Language Sciences, UCL

Much is known about the acquisition of phonological competence and lexical categories, but there has been substantially less research into word meaning development. In an attempt to contribute to this debate, a group of 24 children aged 4-11 were asked to define a set of words, as were a group of 12 adult controls. The stimuli included both concrete and abstract words, in particular words exhibiting a rare form of polysemy known as copredication, which permits the simultaneous attribution of concrete and abstract senses to a single nominal, creating an 'impossible' entity. The results were used to track the developmental trajectory of copredication, previously unexplored in the language acquisition literature.

With respect to a child's knowledge of copredication, it seems that there are only three logically possible developmental stages that children can exhibit: Knowledge of one polysemous sense of the nominal, knowledge of multiple polysemous senses of the nominal (typically limited to two, but sometimes more in cases such as newspaper and city), or knowledge of multiple polysemous senses of the nominal and the interactions these senses permit. For instance, if a child simply understood both polysemous senses of *book* but did not explicitly relate them, they would be unable to understand that two copies of the same informational book could be taken out of a library by different people and be defined as identical, with the criterion of identity relying on the INFORMATION sense at the expense of the PHYSICAL OBJECT sense. These forms of semantic conflict are at the heart of copredication, and it was the goal of this study to explore their developmental basis.

The responses were analysed based on the number of senses each child demonstrated an understanding of, permitting the recording of a clear developmental trajectory for each polysemous nominal. As mentioned, the children exhibited either an understanding of one sense, multiple senses, or (in order to license copredication) they understood that these senses could relate to each other. The data suggests that the children only began to discuss both abstract and concrete senses for all nominals at around age 7. There was also a gradual age-based increase in the number of senses each child demonstrated an understanding of for each nominal. A Kruskal-Wallis H test showed that there was a statistically significant difference in these sense comprehension scores between the different ages, crossing Age (4-11) with Sense Number (1 sense, 2 senses, or an interaction between the senses, coded as 3) across each nominal: $\chi2(7) = 20.296$, $p = 0.005$. In addition, 5 of the 8 nominals displayed significantly different rates of sense production across the age groups: *ship* ($\chi2(7) = 19.190$, $p = 0.008$), *book* ($\chi2(7) = 17.889$, $p = 0.012$), *city* ($\chi2(7) = 17.907$, $p = 0.012$), *person* ($\chi2(7) = 17.090$, $p = 0.017$), and *word* ($\chi2(7) = 17.895$, $p = 0.012$).

The results suggest that copredication has clear developmental stages, with basic forms of copredication emerging at the point of production (though not necessarily comprehension) around the age of 4, but other, more complex forms not emerging until around age 10. Even when prompted to think about the distinct senses of complex polysemous words like *book* and *river* and consider possible relations between them, children below the age of 10 exhibited no ability to comprehend any possible interactions between semantically distinct yet lexically related senses. Finally, follow-up studies concerning semantic training (targeting specific senses) will be discussed.

Effects of statistical variance during acoustic cue acquisition: a GAMM model

Jessie S. Nixon[*1,2] and Catherine T. Best[3]*
[1]New Zealand Institute of Language Brain & Behaviour (NZILBB); [2]University of Tübingen
**jess.s.nixon@gmail.com [3]The MARCS Institute, Western Sydney University*

Recent research has investigated the role of cue variability on prediction behaviour during native language speech perception (Clayards, Tanenhaus, Aslin & Jacobs, 2008; Nixon, van Rij, Mok, Baayen & Chen, 2016). These studies showed that listeners adjust their predictions about speech contrasts that they are already familiar with, depending on the reliability of a given cue dimension. The present 'visual world' eyetracking study investigates how a statistical property of the input distribution affects acquisition of a new cue dimension not present in the native language, namely tone.

Thirty-nine native English-speaking participants saw four images of objects and heard a Cantonese word. Target and competitor images were of word pairs that were identical except for the tone, distinguished by pitch height: high-level (e.g. gon1) or mid-level (e.g. gon3). Auditory stimuli were a 14-step pitch continuum (e.g. gon3 to gon1). All participants heard this pitch continuum in a bimodal, approximately Gaussian distribution. However, the *acoustic variance* (distribution width) varied between participants: high- vs. low-variance. Participants were instructed to click the image of the word and guess if they did not know. They were told that this was a language-learning task, but were not told about the pitch/tones or the language. Feedback ('correct'/'wrong') was given on each trial.

The distance of fixations from the centre of the target picture was analysed using generalised additive mixed models (GAMMs; Wood, 2006). Models showed a significant condition-by-pitch nonlinear interaction over time ($p < 0.001$); there was also a significant condition-by-pitch nonlinear interaction over the course of the experiment (trial; $p < 0.001$). By the end of the experiment, fixations were closer to the target in the low-variance condition compared to the high-variance condition and the difference between conditions increased over the trial. The timing of this effect interacted with pitch value: the effect of condition emerged earlier in the experiment for the mid-level tones and cues far from the category boundary.

In summary, with a more predictive pitch distribution in the low-variance condition, participants learned to discriminate the pitch cues more quickly. By the end of the experiment, participants in the low-variance condition were fixating closer to the target than those in the high-variance condition from early in the trial.

These results provide evidence that in implicit statistical learning of new acoustic dimensions, too much within-category acoustic variance hinders acquisition, and that the ideal learning condition is with low variability in the contrastive dimension. In the low-variance condition, participants were better able to utilise feedback from prediction error to increase weighting of an acoustic cue that was not predictive in their native language.

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Dissociating Effects of Common Ground and Episodic Memory on Partner Specificity in Production

Kieran J. O'Shea, Caitlyn R. Martin and Dale J. Barr, University of Glasgow, UK.

The memory-based approach to language use (Horton & Gerrig, 2005) argues that ordinary memory processes can serve as a proxy for more complex computations about common ground. Its key claim is that conversational partners act as memory cues for the retrieval of relevant information through a process of *resonance* in episodic memory. Although studies have demonstrated effects in reference generation that are consistent with ordinary memory processes (Horton & Gerrig, 2005), there has been no direct test to date of the key claim, which would require experimentally dissociating the effects of episodic memory from effects of common ground. What is needed is a situation in which relying on memory would lead to a different expression than relying on common ground.

We sought to do so using a new video-based chat paradigm in which speakers entrained on referential precedents while seeing and hearing one of two potential 'matcher' co-participants located in an adjacent room who wore headphones. This paradigm enabled us to separately control which matcher appeared on screen from which matcher the speaker believed had access to the audio. Speakers entrained either on modified or unmodified descriptions of referents (e.g., "the unmelted candle" vs. "the candle") while seeing and speaking to a particular matcher, knowing while they did so that the other matcher could neither see nor hear these descriptions (due to a blindfolding/auditory masking procedure). On certain test trials, the same referents appeared in contexts that invalidated the entrained description; for example, a candle that the speaker called "the unmelted candle" because it had appeared along with a second melted candle now appeared in a display where the second candle was no longer present (Brennan & Clark, 1996). To the extent speakers relied on memory during the test trials, they should misspecify these targets. We independently varied whether or not the same matcher was the addressee at test (pragmatic consistency) and whether or not the same matcher appeared on screen at test (perceptual consistency). Note that this implies situations where the on-screen matcher is *not* the addressee. To the extent speakers use memory as a proxy for common ground, misspecification should be higher when viewing the same matcher they saw when they entrained on these descriptions (perceptual consistency); to the extent they use common ground, misspecification should depend on their knowledge of who hears the description (pragmatic consistency). We pre-registered our design on the Open Science Framework at: https://osf.io/5yz3n/. Data from 40 participants were analysed. Contrary to the memory-based model, there was no evidence that speakers misspecified more when viewing the same matcher (57%) than when viewing a different matcher (63%); $z = -2.69$, $p = 1.0$ (pre-registered one-tailed test). We also found no significant difference in misspecification rate when speakers believed they addressed the same matcher (60%) versus a different matcher (60%), $z = -0.62$, $p=0.27$ (pre-registered one-tailed test). To verify that speakers paid attention to the identity of the addressee, we had them describe unconventional target items (abstract grey-scale objects) during training and test. Speakers gave longer descriptions of old referents to a new addressee (mean = 10.6 words) than to the old addressee (mean = 8.2 words), $z=-4.49$, $p<0.01$, indicating that participants were aware of when they were speaking to the alternative matcher at the test phase. In short, we found clear evidence for reliance on memory, in that the misspecification rate was high, as well as for use of common ground, but no evidence the speakers used episodic memory as a proxy. Our results pose a challenge for memory-based models of language use.

Statistical properties of speech directed to typically and non-typically developing toddlers

LUCA ONNIS, Nanyang Technological University, ANNA TRUZZI, PAOLA VENUTI, ARIANNA BENTENUTO, GIANLUCA ESPOSITO, University of Trento, Nanyang Technological University, SHIMON EDELMAN, Cornell University

Parents naturally speak utterances containing partial self-repetitions (e.g., Want to get your ball? Get your ball? Do you want to get your ball?). Such 'structured variation' contains cross-utterance statistical cues to the building blocks of language, and is predictive of children's lexical and grammatical structures (Goldstein et al., 2010).

Here we compared structural characteristics of maternal language directed to toddlers with Autistic Spectrum Disorders (ASD, n = 25), Down Syndrome (DS, n=25), and a control group of Typically Developing toddlers (TD, n=31). We analysed the child-directed transcriptions of child-mother interactions during naturalistic dyadic play interactions.

While children's mean developmental age (24.60 months, SD=8.31) was the same across the three groups, we found that the proportion of sentences in sets of structured variation in child-directed speech was significantly the largest for ASD (55.3±2.8 %), smaller for DS (44.9±2.2%), and the smallest for the TD group (34.7±2.3%).

Because statistically structured variation decreases with chronological age of the child, this finding is even more striking given that ASD, and DS children were on average 2 years (DS) and 3 years older (ASD). Our findings raise new questions on how parental speech shapes language development, and help clarify the link between statistical and language learning. It also opens new ways to use corpus studies to investigate similarities and differences in child-directed speech to typical and atypical developing children.

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Strong competitors facilitate target name retrieval in simple picture naming

Gary M. Oppenheim, Bangor University, UK / Rice University, USA
g.m.oppenheim@bangor.ac.uk

Intro: Semantic 'inhibition' in paradigms like picture-word interference is commonly assumed to reveal core properties of typical word production mechanisms: the distractor word *cat* interferes with naming a picture as *dog* because a lexical selection algorithm requires *dog* to overcome *cat*'s activation, so when *cat* is more activated it takes longer to select *dog*. However, considerable research over the past decade has raised questions about whether such 'competitive' RT effects may merely reflect artefacts of particular experimental tasks. Converging evidence from simpler tasks that lack such obvious experimental manipulations – such as timed picture-naming norms – would therefore strengthen the case that competition is an important, defining feature of typical lexical selection. In norms, name distributions for each picture are typically assumed to reflect the lexical activations on which selection operates, and pictures with higher name agreement are typically named faster than those with lower name agreement. Typical competitive selection accounts further predict that, *ceteris parib*us, concentrated competition from strong alternatives should hinder dominant name retrieval more than diffuse competition from an array of weaker competitors. For instance, given a picture that 50 people out of 100 name as *truck*, selecting *truck* should be slower if the remaining responses are split <45,5> between *lorry* and *van* (indicating a competitor nearly as strong as the target) than if they were split <25,25>.

Methods: After collecting timed naming norms from 100 native UK English speaking students for the 525 black and white line drawings of the International Picture Naming Project (Bates et al, 2003), via standard norming procedures (ibid), for each picture I identified the dominant (i.e. most common) and secondary (i.e. second most common) names and their observed frequencies.

Results: For 246 items, the dominant and secondary names were identified as coordinates of the same semantic category at the same level of specificity. These included synonyms and near-synonyms, e.g. truck/lorry, turtle/tortoise, but conservatively excluded simple morphophonological reductions or extensions, e.g. plane/aeroplane, hippopotamus/hippo, which might be considered subforms of a single lemma. Thus, for these items, the secondary name clearly represents a competitor for the dominant. Then, restricting the dataset to just the 18,516 trials in which participants produced the dominant name for these items, linear mixed effects regressions predicted their naming latencies as a function of the observed frequencies of both the picture's a.) dominant name and b.) secondary name. Remarkably, increases in each predictor were associated with faster naming latencies. Observing faster dominant name RTs when the dominant name emerged more frequently replicates previous demonstrations that higher name agreement facilitates picture naming. But observing faster dominant name RTs when the *secondary* name emerged more frequently provides a novel challenge for theoretical claims that strong competitors should delay target word retrieval via competitive selection mechanisms.

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Animates create interference: How Basque reduces it

Luis Pastor & Itziar Laka
University of the Basque Country (UPV/EHU)
luis.pastor@ehu.eus

Two animates create semantic interference in sentence planning [1]. Studies in nominative languages show that this animacy interference is avoided by means of two strategies: one involves increasing the linear distance between the arguments (passive) [2]; the other involves omission of one of the arguments (impersonals or subject drop) [2,3].

Here we present data from a corpus study about animate argument omissions in Basque, an ergative language with no passives but free word orderand with subject and object pro-drop. We hypothesize that when the sentence contains two animate arguments, Basque will resort both to increasing linear distance by means of postverbal arguments and to argument omission. To this end, we extracted 3003 transitive sentences from two written Basque corpora. Sentences were obtained from newspaper articles, book chapters and a TV series script, and they were manually coded for animacy, pro-drop and word order.

Our results suggest that not all languages resort to the same general strategies to avoid animacy interference. Basque does not reduce the interference increasing the linear distance by placing one animate postverbally (Figure 1). Basque appears to reduce the interference by omitting the subject (Figure 2). Pro-drop results converge with the results in Chinese [3], although the omission-for-animacy effect is smaller in Basque. This may be due to the difference in null arguments type: *pro*-drop (Basque) and *topic*-drop (Chinese). Overall, these results suggest that argument omission is less costly than displacement [4,5,6], and hence whenever omission is possible, languages will preferably resort to it to avoid animacy-triggered interference.

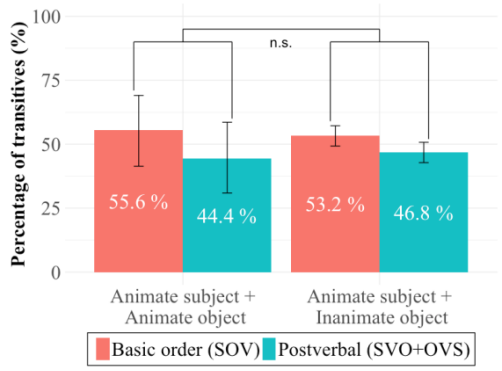


Figure 1. Frequencies of basic order sentences and postverbals sentences (SVO+OVS) grouped by subject and object animacy.

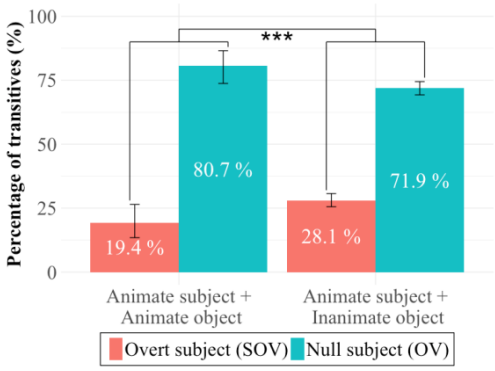


Figure 2. Frequencies of overt subject sentences (SOV) and null subject sentences (OV) grouped by subject and object animacy.

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Clearly understood? Linguistic determinants of comprehension of health-related information

Michael Ratajczak[1], Judit Kormos[1], Robert Davies[1], and Megan Thomas[2]
Lancaster University[1], Blackpool Teaching Hospitals NHS Foundation Trust[2]

Relatively little attention has focused on whether and how the effects of individual differences and linguistic properties of texts influence reading comprehension of health-related information. This issue is a significant concern in health settings, as reading comprehension problems are associated with poor health outcomes and more hospital admissions (e.g. Baker et al., 2002). We report a study to uncover what linguistic characteristics of health-related texts predict reading ease. Our study had two parts. In the first, we examined whether the values yielded by two commonly used readability algorithms coincided in ranking the ease-of-understanding of a sample of texts. In the second, we examined whether algorithmically generated readability ranks correlated with the perception of readability of the texts in adult readers.

First, we collated an opportunity sample of 86 health-related documents from the websites of various National Health Service England Trusts. These health-related documents were analysed using the Coh-Metrix application (Graesser, McNamara, Louwerse, & Cai, 2004) to derive two indications of readability, the Flesch Reading Ease index (Flesch, 1948), originally developed for English first language (L1) speaking children, and the Coh-Metrix L2 Readability index (RDL2; Crossley, Greenfield, & McNamara, 2008) designed for second language (L2) users. Our analyses showed that the two readability indices were not significantly correlated, which suggests that they do not measure the same construct. Linear models of the readability values, per text, generated according to each index, indicated that relative readability were affected by different influences. This suggests that different linguistic features determine the readability values derived from the different algorithms. Moreover, the findings revealed that following common information-writing guidelines in applied health care settings may not improve comprehension of health-related documents.

Next, we investigated the factors that influenced readers' perceived comprehension of health-related texts. We tested 129 participants from different backgrounds, including ESL speakers. The participants completed a Short Test of Functional Health Literacy in Adults (Baker, Williams, Parker, Gazmararian, & Nurss, 1999), and rated eight health-related texts of varying linguistic features in terms of their understanding. We found that the RDL2 and the Flesch Reading Ease did not predict the perceived ease of understanding of the texts. The perceived comprehension was influenced by participants' age, education, and health literacy. This suggests that readability algorithms may be insufficient to determine the readability of health-related texts.

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Emotional content and enduring mood independently affect false memories

Javier Rodríguez-Ferreiro, Universitat de Barcelona; M. Carmen Aguilera, Universitat de Barcelona; Robert Davies, University of Lancaster

Emotion has been shown to promote the formation of false memories, an effect that has been explained as due to enhanced semantic activation for emotionally relevant stimuli. However, contradictory results have been observed regarding the impact of the specific emotional content of the stimuli (valence and arousal) and the influence of personal characteristics such as mood (Bookbinder & Brainerd, 2016). We used a false memory procedure (Roediger & McDermott, 1995) to study the effects of valence and arousal on semantic processing and their possible interaction with enduring negative mood.

A group of 122 healthy young adults with no prior diagnosis of mood disorders were presented auditorily with a set of 18 lists composed of 12 words semantically associated to 18 not-presented critical lures. Critical lures varied in valence (negative, neutral, positive) and arousal (high, low). The negative, neutral and positive valence subgroups of critical lures were matched for lexical frequency, letter length and average degree of association with their respective lists and so were the high and low arousal subgroups. Then, the participants responded to a false recognition questionnaire consisting of previously presented words and the critical semantically related not-presented words, as well as weakly related and unrelated not-presented fillers. Participants rated their confidence in recognizing each word on a 1-4 scale. After finishing the recognition test, the volunteers were asked to fill-in the BDI-II questionnaire (Beck, Steer, & Brown, 1996) to assess symptoms of depression.

Generalized Linear Mixed-effects Models showed that word valence influenced the confidence of the participants, with higher recognition confidence elicited by negative items. However, we did not observe any significant effects of arousal on the recognition ratings. In relation to negative mood, volunteers with higher BDI-II scores showed increased acceptance rates for semantically related not-presented words. Neither the effect of valence nor that of arousal interacted with this significant effect of persistent mood. The inclusion of control variables -- lexical frequency, word length, orthographic neighbourhood and bigram frequency, as well as participants' age and sex -- did not change these results.

Our data show independent effects on false memories of the emotional content of the words and individual differences in mood. Whereas negative word valence increased recognition ratings, persistent negative mood reduced discriminability between presented words and semantically related not-presented lures, indicating a greater predisposition to false memories. These results highlight the influence of both the characteristics of the stimuli and of the individual on semantic processing and further inform our understanding of the role of emotion in memory formation.

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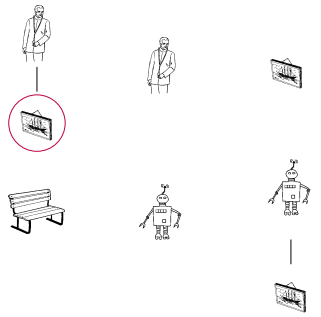
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Conceptual ambiguity facilitates non-linear phrase planning

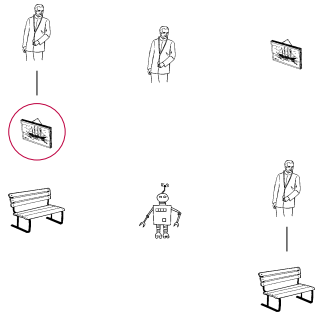
Jens Roeser, Mark Torrance, & Thom Baguley (Nottingham Trent University)
jens.roeser@ntu.ac.uk

The scope of sentence planning prior to speech onset embraces, at minimum, the first determiner-noun pair (Griffin, 2001). In conditions that are as yet unclear the production system exceeds this incremental scope (see Konopka and Brown-Schmidt, 2014). Evidence for such a non-linear planning strategy comes from studies that found longer onset latencies for syntactically more complex noun phrases compared with hierarchically simple phrases. This suggests that linear planning allows delay of some processing until after production onset (Allum and Wheeldon, 2007; Lee et al., 2013). However, whether or not syntax is permitted to unfold through incremental processing must necessarily be determined at a pre-syntactic planning stage. We examined whether a conceptual plan determines whether or not sentence planning proceeds incrementally, independently of syntactic structure.

In three image description experiments (Ns=32, 64, 64) subjects were required to name one image in an array (e.g., the painting in Fig. 1), using a modifier (the doctor) for disambiguation in one of two contexts: The head noun referent appeared in the presence of an identical comparator with a different modifier (Fig. 1a) or a different comparator with an identical modifier (Fig. 1b). If non-linear planning was introduced during the conceptualisation process, we would predict more advanced planning for the modifier of ambiguous head referents (the doctor in Fig. 1a) as participants had to uniquely identify the target referent. These contexts were tested for both modifier-head (e.g., *the doctor's painting*) and head-modifier structures (e.g., *the painting with the doctor*). For context 1a we found consistently more eye movements to the modifier referent before production onset. Shorter onset latencies for contexts such as Fig. 1a were observed for modifier-head (Exp. 1) and head-modifier structures (Exp. 3). This suggests that ambiguous head nouns required planning of the modifier referent. We conclude that the conceptual plan influences the linearly of the planning process even when the syntactic structure is held constant.



(a) Head contrast: not the robot's painting



(b) Modifier contrast: not the man's bench

Fig. 1: *the man's painting* / *the painting with the man* (Exp. 3)

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Statistical Learning over Sociolinguistic Cues in Children and Adults

Anna Samara[1,2], Kenny Smith[3], Helen Brown[4], Chantal Miller[2], & Elizabeth Wonnacott[2]
[1]Liverpool University, [2]UCL, [3]University of Edinburgh, [4]University of Warwick

Languages exhibit sociolinguistic variation, such that adult native speakers condition the usage of linguistic variants on social context, gender, and ethnicity, among other cues. While the existence of this kind of socially conditioned variation is well-established, there is debate as to the role of such cues in child language learning (e.g., Labov, 2013; Smith, Durham, & Richards, 2013). Studies of naturalistic language use by children provide various examples where children's production of sociolinguistic variants appears to be conditioned on similar factors to adults' production, but it is difficult to determine whether this reflects knowledge of sociolinguistic conditioning or systematic differences in the input to children from different social groups. Furthermore, artificial language learning experiments have shown that children have a tendency to eliminate variation, a process which could potentially work against their acquisition of sociolinguistic variation. The current study used a semi-artificial language learning paradigm to investigate learning of the sociolinguistic cue of speaker identity in 6-year-olds and adults.

Method: Participants were trained (over four days) and tested on a semi-artificial language where nouns were obligatorily followed by one of two meaningless particles (bup or kem, e.g. glim pig bup; lit: TWO-PIG-PARTICLE, translation: "Two Pigs") and were produced by one of two speakers (one male, one female). In Experiment 1 (deterministic conditioning), the two particles were equally frequent in the learner's input, but their use was entirely predicted by speaker identity (e.g., one speaker always used bup and the other speaker always used kem). In Experiment 2 (probabilistic conditioning), both speakers used both particles, but had different probabilistic preferences (speaker 1 used bup 75% of the time, speaker 2 used kem 75% of the time). In Experiment 3 (unconditioned variation), both speakers used both particles equally frequently. Participants undertook production tasks at the end of day 1 and day 4 in which they were prompted to complete sentences as produced by one of the two speakers. At the end of the last session, participants also took a forced choice test recording whether they chose the option with the majority form for that speaker.

Results: In Experiments 1 and 2, both children and adults successfully acquired the speaker identity cue, although the effect was stronger for adults and in Experiment 1. In addition, in all three experiments, there was evidence of regularization in participants' productions, although the type of regularization differed with age: children showed regularization by boosting the frequency of one particle at the expense of the other, while adults regularized by conditioning particle usage on lexical items. Overall, results demonstrate that children and adults are sensitive to speaker identity cues, an ability which is fundamental to tracking sociolinguistic variation, and that children's well-established tendency to regularize does not prevent them from learning sociolinguistically conditioned variation. Further work in our lab using a semi-artificial language that features multiple speakers of each gender during training and novel speakers at test suggests that 6-year-old children can also *generalize* over a deterministic association between speaker identity and particle usage.

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The role of shape information in object naming

Margit Scheibel & Peter Indefrey (Heinrich-Heine-Universität Düsseldorf)

Research on spoken word production typically takes the activation of a to-be-named concept as a starting point and focuses on the processes thereafter. In the last decades, numerous studies provided evidence for the influence of semantic context on the speed of lexical retrieval. However, these studies failed to consider that even the activation of concepts might be context-sensitive in two ways: (i) with respect to the sufficient precision of the concept's feature information and (ii) with respect to the effort for the concept's (re-)recognition. In picture naming, the activation of concept representations relies strongly on shape information. Thus, concept activation is mostly determined by the visual percept of the input. In view of results from psychological studies showing that visual feature perception is context- and category-dependent, we tested whether the necessary precision of shape information in object naming is influenced by semantic context (Exp. 1); and how the precision of available shape information modifies naming latencies, possibly interacting with semantic context (Exp. 2).

In a first semantic blocking experiment (n=41), line drawings of objects from visually consistent and visually variable categories were presented in graded image-blurring sequences (19 steps from strongly blurred to precise). The results showed that less shape details were required to name an object in homogeneous contexts (compared to heterogeneous contexts, $p<.05$). This facilitating effect was particularly strong for members of visually variable categories. Based on these findings, we argue for a recognition advantage of homogeneous contexts: By reducing the number of alternatives that are considered as possible concepts during objects recognition homogeneous contexts increase the accuracy of the matching of perceived features with stored shape representations. So, even coarser shape information becomes sufficiently distinctive for concept recognition.

To investigate the impact of shape precision on naming latencies, Exp. 2 (n=36) was designed as a modified cyclic semantic blocking experiment. Two novel variables were added: the precision of shape information (precise, medium-, strongly blurred) and the within-category shape structure (consistent vs variable). The results showed two opposed context effects. Both were enhanced in adverse recognition conditions.

On the initial cycle, homogeneous contexts (compared to heterogeneous contexts) accelerated object naming (especially for members of visually consistent categories) and this beneficial effect was stronger in the blurred conditions. This result suggested that the recognition advantage observed in Exp. 1 affects the speed of first object naming. An indication for an initial facilitating effect has already been reported by Damian & Als (2005) who also found slightly shorter latencies for first item presentations in homogeneous contexts. However, their interpretation of a semantic priming effect cannot explain the stronger facilitation in blurred conditions we observed. By contrast, a recognition advantage due to a context-dependent reduction of possible concepts would be expected to increase with the number of possible concepts, i.e. with blurring. From the second cycle onwards, homogeneous contexts hampered object naming. This detrimental effect was again strongest for strongly blurred versions of objects from visually consistent categories. Following Damian and Als (2005), we assume the detrimental context effect to be due to lexical competition. The interaction can be explained by a higher number of lexical competitors due to blurring or consistent shape structure. In sum, our results suggest that not only the semantic context but also the precision of shape information matters in object naming because it directly affects the number and degree of co-activated concepts and lexical competitors.

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An investigation of L2 gender-based anticipation. Is it a lexical deficit?

Kailen Shantz & Darren Tanner
University of Illinois at Urbana-Champaign

Grammatical gender is challenging for adult second language (L2) learners. Recent corpus work has shown that prenominal gender marking makes nouns more predictable in context (Dye et al., 2017), and experimental work has shown that native (L1) speakers can take advantage of this property of gender marking to anticipate upcoming nouns (e.g. Lew-Williams & Fernald, 2010). Despite the predictive value of gender marking, late L2 learners do not reliably use prenominal gender marking predictively (e.g. Grüter et al., 2012). The Lexical Gender Learning Hypothesis (LGLH) proposes that learning context and variability in gender assignment underlie this reduced use of gender as an anticipatory cue.

No study has yet directly tested these claims. To that end, we used an artificial language learning task with the visual world eye-tracking paradigm (VWP) to directly test the LGLH. Native speakers of English (N = 32) learned an artificial grammar in learning conditions that emulated L1 or L2 acquisition (cf. Arnon & Ramscar, 2012). This was followed by a VWP task that assessed the extent to which learning condition influences predictive use of grammatical gender. Participants also performed two gender assignment tasks to measure their gender assignment variability.

When data are analyzed irrespective of gender assignments, we find no evidence that either group of participants uses gender predictively (Fig. 1). Regardless of learning condition, neither group was more likely to fixate a target noun prior to the onset of the noun when gender could be used to predict, nor were they faster at shifting their gaze to the target object. When trials are restricted to those for which participants consistently assigned the correct gender to the target and distractor nouns, however (reducing gender assignment variability), the group with the L1-like learning condition shows strong evidence for prediction in both eye movement measures, while the group with the L2-like learning condition shows no evidence of prediction (Fig. 2). Results are thus consistent with the LGLH in finding effects of both learning context and gender assignment variability.

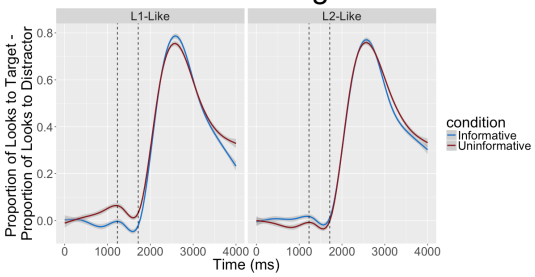


Figure 1. Target advantage by group and condition (95% CI). Dashed lines mark the time during which linguistically mediated eye movements can only be guided by the article.

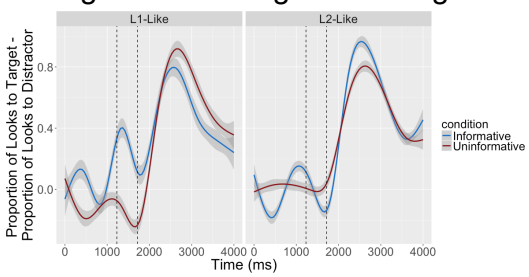


Figure 2. Target advantage for gender-stable trials only by group and condition (95% CI). Dashed lines mark the time during which linguistically mediated eye movements can only be guided by the article.

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Gender and Declension in Agreement Processing

Natalia Slioussar[1,2] & Pavel Shilin[2]
[1]Higher School of Economics, Moscow, Russia; [2]Saint-Petersburg State University, Russia

Many experimental studies examined different aspects of number agreement, while agreement in other features received less attention. We report a self-paced reading experiment studying how the inflectional class (declension) a noun belongs to and its gender influence the processing of gender agreement in Russian. Adjectives, participles and verbs (in past tense) show gender agreement.

Russian has two numbers and six cases, and every declension has a different set of endings associated with them. About 46% of Russian nouns are 2nd declension masculine (*syn* 'son'), 29% are 1st declension feminine (*zhena* 'wife'), 18% are 2nd declension neuter (*okno* 'window'), 5% are 3rd declension feminine (*mat'* 'mother'), 1% are 1st declension masculine (*djadja* 'uncle'), and 1% are classified as irregular (the numbers are taken from (Slioussar & Samojlova, 2015)). Thus, most consonant-final Nom.Sg forms are masculine, and most feminine Nom.Sg forms end in *-a/ya*, with 3D feminine nouns being less usual.

The experiment included 36 target sentence sets and 80 filler sentences. Sentences in one set contained the same six words except for the first one, the subject noun (2D-M / 1D-F / 3D-F, balanced in frequency and length) and the second one, the verb form (M or F). This yielded six experimental conditions, three of them with a gender agreement error. Sentences from each set in different conditions were distributed across six experimental lists. 33 native speakers participated in the experiment.

Average RTs are shown on Fig.1. RTs were analyzed using RM ANOVA. Agreement errors were noticed significantly later with 3D-F nouns than with 1D-F or 2D-M ones. However, error-related delay on subsequent words was significantly more pronounced for M subjects than for F ones (both 1D and 3D). The latter result suggests that predictions we make about predicate gender are stronger for M subjects (see also (Slioussar & Malko, 2016) for agreement attraction). The former shows that interestingly, the speed of error detection is at least partly independent from that, being affected by inflectional regularity: 3D feminine nouns 'look like' more frequent masculine ones, so the error is noticed later.

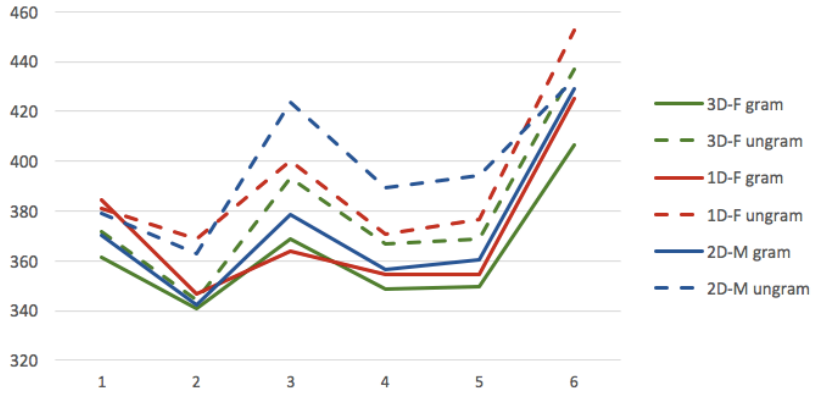


Fig. 1. Average word-by-word reading times in different conditions.

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Opting out as a measure of meta-linguistic awareness in children

Sybren Spit, Enoch Aboh, Sible Andringa and Judith Rispens
University of Amsterdam

A common assumption is that children learn a language entirely implicitly and without any conscious awareness of form and grammar (Wijnen 2013), but this assumption has never been addressed experimentally. We present a novel experimental method to examine awareness of linguistic rules in children. This method is derived from the assumption that learners may be phenomenologically aware (when they can verbalize their experiences) or aware at the level of access (when they cannot verbalize or remember their experiences coherently; Cleeremans 2008). Traditional methods investigating awareness, such as verbal reports, tap into the former type of awareness (Timmermans & Cleeremans 2015). For young children, these methods are problematic as they might be unable to reflect explicitly on learned linguistic structures. To investigate awareness of linguistic regularities in this population, we adapted the opt out paradigm, which makes claims about awareness in animals and might tap into access awareness (Hampton 2001).

26 Dutch adults (18 females, *M* = 22;9) and 48 kindergartners (24 females, *M* = 5;5) participated in an experiment in which they had to figure out a correspondence rule based on the Dutch determiner system. Dutch nouns (e.g. *paard* 'horse') got replaced by pseudowords (e.g. *orbo*). Pseudowords were introduced by the article that precedes the Dutch noun. Dutch nouns are either common or neuter gender, both receiving a different definite article (*de* or *het*), but the same indefinite article (*een*). In a learning phase, participants received limited input to learn the meaning of the pseudowords. In a test phase, participants performed a picture matching task, where sentences containing the pseudowords (*in de wei staat het orbo* 'the orbo stands in the meadow') were presented. From the possible answers, one picture referred to a common noun, the other to a neuter one (*het paard* 'the horse' vs. *de koe* 'the cow'). As input was limited, correct decisions could be made on the basis of the article before the pseudoword. Crucially, they earned 2 points for correct decisions, but 0 points for incorrect decisions.

After 24 test trials, the opt out phase started. Participants heard unfinished sentences, terminating after the definite or indefinite article (*in de wei staat een* 'in the meadow stands a'). Participants could decide to listen to the full sentence and give an answer on the picture matching task, again earning 2 points for correct decisions, but 0 for incorrect ones. However, they could also opt out, which would earn them 1 point. If participants are at some level aware of the rule, they would do well to opt out when the sentence terminates after an indefinite article. A correct decision cannot be made, but they still earn a point. Conversely, when the sentence ends with a definite article, continuing should be preferred .

Results show adults detected the rule (*OR* = 11.07, *z* = 2.696, *p* = .007) and were aware of it (*OR* = 2.20, *z* = 2.340, *p* = .019). They provided more correct answers when sentences contained the predictive definite article, while they opted out more with unpredictive indefinite articles. Furthermore, performance on the testing and opt out phase was correlated (*r* = 0.489, *p* = 0.011). For children, the correspondence rule proved to be too difficult. However, they both opted out and continued to hear full sentences, showing the reward system might be suitable for young children, once they can adapt their strategic behavior to a learnable rule. Thus, the next step towards a successful paradigm to study awareness in young learners is the development of a learnable miniature language.

Acquisition of categorical non-adjacent dependencies in an artificial grammar

Jesse Storbeck, Elsi Kaiser, & Toben Mintz (University of Southern California)
jstorbec@usc.edu

A key feature of natural language is that linguistic elements can depend on each other. These elements may be either temporally adjacent or occur over some distance. Most prior experiments on non-adjacent dependency (NAD) acquisition in an artificial grammar used a frame such as AXB, where syllables A and B are in a mutually-predictive (1:1) relationship, and X is an unrelated element (e.g. Gómez, 2002).

However, NADs found in natural languages often involve categories of elements, rather than mutually-predictive pairs. For instance, in *that big dog*, the determiner *that* forms an NAD with the noun *dog*, since the form of the determiner is dependent on the number of the noun. Of course, *that* and *dog* are not mutually predictive in English; rather, this NAD is a relation between a functional category {*this*, *that*, *a*, …} and a lexical category {*dog*, *cat*, *car*, …}, with the intervening adjective providing no information about the dependency. Furthermore, this NAD is in competition with its plural counterpart: {*these*, *those*, *all*, …} [adj.] {*dogs*, *cats*, *cars*, …}. These NADs are unlikely to be represented in the adult grammar as relations between discrete pairs of words.

While previous work has demonstrated that learners of an artificial grammar can rely solely on statistical information to acquire 1:1 NAD pairings, learning categorical NADs is likely to be a more difficult task. Van den Bos et al. (2012) found that adults failed to learn categorical NADs unless they received additional visual or phonological cues during training. Nevertheless, Wang et al. (2016) suggest that the results of some previous NAD learning studies may have been influenced by unnaturally slow rates of presentation and increased salience of elements occurring at utterance edges.

Design: To test acquisition of categorical NADs based only on the co-occurrence of syllables, we exposed adults to an artificial grammar containing two NAD categories and asked them to rate the familiarity of sequences of trained nonce syllables (e.g. *geed roov dauk*; task and instructions based on Wang et al. and Mintz et al. (2014)). The grammar contained more unique dependencies than van den Bos et al.'s, as well as optional syllables before and after NADs to disrupt edge-based computations. Stimuli were presented at a more natural rate of 3 syllables/second. Participants rated 3 types of "grammatical" test sequences: **(i)** NADs heard during training with the same intervening syllable, **(ii)** NADs heard during training with a novel intervening syllable, and **(iii)** NADs which did not appear during training, but for which there was distributional evidence based on category membership. For each of these types, we also tested "ungrammatical" foils which intermingled the two competing NAD categories (cf. **these big dog*).

Results: Participants rated trained NAD/intervener sequences **(type i)** significantly more familiar than their foils (lmer, t=2.72), suggesting that slow presentation and edge alignment may have prevented NAD learning in van den Bos et al. We found no evidence, however, that people discriminated untrained sequences **(types ii, iii)** from their foils. Our results show that adults can learn categorical NADs based on co-occurrence statistics, but performance may be modulated by adjacent transitional probabilities and explicit memory.

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Sensory Worlds: a neo-Whorfian view of language-specific sound symbolism

Suzy J Styles
Nanyang Technological University, Singapore

According to Whorf, "all observers are not led by the same physical evidence to the same picture of the universe, unless their linguistic backgrounds are similar […]" (Whorf, 1940: 1956). Although opinions differ about whether language truly determines thought, the *neo-Whorfian* approach identifies cognitive or perceptual *biases* that are predicted by specific linguistic patterns – for example, the influence of grammatical gender on recall for pairs of nouns (Boroditsky, Schmidt, & Phillips, 2003) or the influence of colour labels on the speed of colour matching (Winawer et al., 2007). Such effects may be subtle, short lasting, and fragile, but they demonstrate that well attested linguistic patterns become encoded in such a way that they can modulate other automatic processes. In the domain of language acquisition, it is well established that infants begin language learning with a 'universal' human sensory system, which then adapts to the acoustic structure of the language environment (Kuhl, 2010; Werker & Tees, 1984). This kind of adaptation is not normally considered within the Whorfian framework, however, in this case, language clearly modulates acoustic perception (for speech sounds). Do these effects persist outside of listening for comprehension? Do they transfer into the cross-modal domain?

In the well known 'maluma/takete' task, people from a variety of language backgrounds prefer to link certain kinds of sounds to certain kinds of shape with a high level of regularity (e.g., 'maluma' curvy, 'takete', spiky Köhler, 1929:1947). The consensus in the literature is that linguistic sound symbolism is universal, like other forms of cross-modal perception. However, if statistical exposure to differently structured languages alters acoustic perception of speech sounds, we should predict that cross-modal experiences of language are also altered. This paper reviews evidence from our recent maluma/takete style studies in English, Mandarin, and Syuba. We show that (a) where linguistic sounds violate the statistical structure of a speaker's language, participants do not perform cross-modal matching in the expected way, and (b) where linguistic systems differ in the *features* of a speech signal that are important for linguistic understanding, then speakers of different languages can experience radically different cross-modal matching. (c) we also present preliminary evidence about the developmental time-course of the language-specific cross-modal processing, with a norm for bilingual six year olds. These findings demonstrate that people who speak different languages inhabit subtly different 'sensory worlds,' shaped by the way their linguistically 'tuned' hearing feeds into other sensory systems. Indeed, as Whorf would have it, observers with different language backgrounds are not lead by the same physical evidence to the same picture of the universe.

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Speaking versus sorting: Interaction in L2 does not produce more L1-like categories in L2 speakers

Ellise Suffill, University of Edinburgh, UK.
Holly Branigan, University of Edinburgh, UK.
Martin Pickering, University of Edinburgh, UK.

How does interaction affect categorization, and how might this vary between native (L1) and non-native (L2) speakers? When speakers of the same L1 use labels to categorize objects, they sometimes categorize more similarly to each other than when they do not use labels to categorize [3]. Bilinguals have knowledge of multiple linguistic systems that map words onto to objects in differing ways [1]. Interaction and exposure to another person's categories can play a fundamental role in learning how that person conceives and labels particular concepts, and hence in developing categories that are similar to theirs [3]. Given this, interaction may affect (monolingual) L1 speakers and (bilingual) L2 speakers differently when they interact with each other. In particular, we might expect L2 speakers to develop categories that are more native-like. We investigated whether L1-L2 interaction leads L2 speakers to categorize in the same way as L1 speakers.

In a pre-test, L1-English (n=20) and L2-English/L1-Mandarin (n=20) speakers categorized 128 dishware items using labels (*bowl* vs. *plate)*; this demonstrated significantly different labelling patterns between the two speaker groups (p<.001). Then, in six rounds, 40 pairs of participants (each comprising an L1-English and an L2-English/L1-Mandarin speaker) individually categorized dishware using English labels, then discussed their categories or an unrelated topic after each round. Following category-relevant interaction, L2 speakers' categories shifted (M=6.05) significantly more than L1 speakers' (M=4.65) (β=-1.68, SE=0.63, p<.05) - however, the L2 speakers' categories did not become more L1-like, and category-relevant interaction did not increase alignment within pairs ($p>.05$). Instead, L2 speakers tended to categorize more similarly to other L2s post L1-L2 category-relevant interaction, than did L1 speakers as a group (β=1.20, SE=0.37, p<.05).

These results suggest that interaction in an L2 can reinforce bilinguals' categories in a way that does not reflect L1-like categories in the language of interaction. Greater convergence across bilinguals' categories than across monolinguals' categories on the basis of simplified category structures [2] has been found in early bilinguals, but is surprising here as our bilinguals were relatively late learners of English. Our results also suggest that alignment at a linguistic level does not always lead to greater alignment at a conceptual-categorical level – even though L1s and L2s used the same labels as each other when categorizing, this did not lead to greater categorical alignment between them post-interaction.

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Assessing Priming for Intonational Phrase Boundaries in Ambiguous Sentences

Kristen M. Tooley (Texas State University), Agnieszka E. Konopka (University of Aberdeen), & Duane G. Watson (Vanderbilt University)

Recent research investigating priming for prosodic representations reveals an interesting asymmetry: speech rate is readily primed by previously heard speech (Jungers & Hupp, 2009), but intonational phrase boundaries (IPBs, i.e., pauses) are not (Tooley, Konopka, & Watson, 2014). This suggests that IPBs and speech rate may have different underlying representations. However, it is also possible that IPBs are primeable only in so far as they provide useful information to the listener. While previous studies showed no evidence for IPB priming in sentences with optional IPBs, here we compare priming of informative IPBs (i.e., IPBs that provide disambiguating information) and non-informative IPBs (i.e., IPBs in unambiguous sentences).

Participants (*N* = 73) *heard* recorded primes with or without an IPB spliced into a critical location and repeated the primes aloud. They then silently *read* a target sentence and finally repeated it aloud from memory. Prime sentences were ambiguous or unambiguous. Half the items had the critical location after the first prepositional phrase ([for/in] the basket // on the table; Table 1) and half after the first noun (not shown). The target sentences were always ambiguous. The Ambiguity and Boundary factors were counterbalanced within participants and items. Prime-target pairs were separated by three fillers, which varied randomly between listen and read trials.

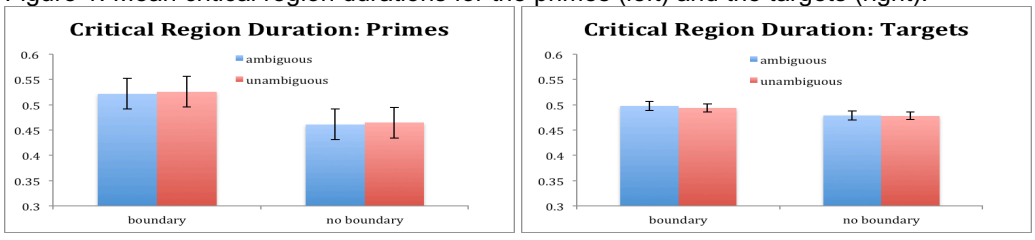
Table 1: Example Sentences

Sentence Type	Sentence	Ambiguity	Boundary
Prime A	She put the money for the basket on the table.	Unambiguous	No boundary
Prime B	She put the money for the basket // on the table.	Unambiguous	Boundary
Prime C	She put the money in the basket on the table.	Ambiguous	No boundary
Prime D	She put the money in the basket // on the table.	Ambiguous	Boundary
Target	He threw the marble in the bucket in the yard.		

Production of IPBs in target sentences (measured as the duration of the critical region, from the onset of the pre-boundary word until the offset of the post-boundary word) after unambiguous primes may occur due to priming of a syntactic interpretation from the prime to the target. Importantly, if priming is more likely when IPBs are informative, there should be more IPBs in target sentences after ambiguous than unambiguous primes.

A mixed-effects model with the maximal random structure showed an effect of Boundary and a Boundary x Sentence Type interaction (*p*'s<0.05): durations at the critical region were longer after recorded primes with than without IPBs, and this effect was larger in the repeated primes compared to the targets. Restricting the analysis to the targets revealed an effect of Boundary (*p*<0.05) but no Boundary x Ambiguity interaction (*p*>0.05). Thus, the effect of the IPBs on the target is likely due to priming of syntax, rather than priming of the boundary itself. This is consistent with past findings that IPBs are not amenable to priming in production, and suggests that IPBs may be represented separately from aspects of prosody such as speech rate.

Figure 1: Mean critical region durations for the primes (left) and the targets (right).



The influence of contextual factors on sarcasm processing: Evidence from eye-tracking during reading

Alexandra Țurcan and Ruth Filik (University of Nottingham)

Contemporary accounts of sarcasm comprehension make different predictions regarding the influence of contextual factors on the processing of a sarcastic comment. Specifically, modular accounts (e.g., Giora, 2003; Grice, 1975) predict that contextual factors cannot influence initial processing, whereas interactive accounts (e.g., Pexman, 2008) predict that they can. Thus, in order to test the predictions of these accounts, two eye-tracking studies were designed to investigate the influence of contextual factors on sarcasm comprehension.

Both experiments required participants to read a series of scenarios that could end in either a literal or a sarcastic target remark. In Experiment 1, the context was manipulated by introducing a sarcastic character (or not). Specifically, the character made a sarcastic utterance earlier on in the text, thereby introducing an expectation for sarcasm in a subsequent (target) remark. This was compared to a control condition in which the character's earlier utterance was literal. Participants' eye movements were monitored while they read the scenarios, and reading times were analysed for the critical word which disambiguated the target remark as being either literal, or sarcastic (e.g., for a target comment such as "*I knew you were gallant!*", which would be literal when the recipient had done something chivalrous, or sarcastic if they had not, the target word would be "*gallant*"). Results showed that regression path and total reading times on the target word were longer for sarcastic than literal target utterances when the speaker had not been introduced as being sarcastic. However, when they had, there was no difference in first-pass, regression path, or total reading times for sarcastic compared to literal comments. This suggests that speaker-related cues in the context can influence the ease of processing of subsequent remarks, that is, when the speaker is known to be sarcastic, there is no observable processing difficulty for subsequent sarcastic remarks.

In Experiment 2, the literal or sarcastic target remark either was or was not an echo of a previous contextual utterance (Sperber & Wilson, 1981). For example, a target utterance such as "*Your tennis skills are fantastic!*" would appear in a context where the recipient of the comment either had or had not previously alluded to being good at tennis. Results showed shorter regression path reading times on the critical disambiguating word (e.g., "*fantastic"*) for comments that echoed an antecedent than those that did not. There were also longer total reading times for sarcastic than literal comments that had no antecedent in the context, but this processing difficulty for sarcastic comments disappeared in conditions where there was an antecedent. That is, echoing a contextual antecedent made sarcastic comments as easy to process as literal equivalents. Implications for theories of sarcasm comprehension will be discussed.

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The positive effect of observing and producing beat gestures on children's narrative abilities

Ingrid Vilà-Giménez[1], Alfonso Igualada[2,1], Pilar Prieto[3,1]
[1]*Department of Translation and Language Sciences, Universitat Pompeu Fabra (Spain)*
[2]*Universitat Oberta de Catalunya (Spain)*
[3]*Institució Catalana de Recerca i Estudis Avançats (ICREA)*
ingrid.vila@upf.edu, aigualada@uoc.edu, pilar.prieto@upf.edu

Recent studies have shown the beneficial role of rhythmic beat gestures in the recall and comprehension of information by preschoolers (e.g. Austin & Sweller, 2014; Igualada, Esteve-Gibert, & Prieto, 2017; Llanes-Coromina et al., under revision). However, to our knowledge, less is known about whether observing and producing beat gestures can serve a role in boosting children's narrative skills. We believe that the focus marking and the discourse structure marking properties of beat gestures, as well as their rhythmic marking properties (Shattuck-Hufnagel et al., 2016) can lead to beneficial effects in narrative development (in fluency and discourse structure properties).

The present study investigates whether training children in observing beat gestures (Experiment 1) and in producing them (Experiment 2) while performing a narrative task can promote their narrative discourse skills.

For Experiment 1, forty-four 5- and 6-year-old children participated in a between-subject training study with a pretest and posttest design. They were exposed to a training phase with a total of six one-minute stories, presented under two between-subject experimental conditions: 1) *no-beat condition*, e.g., narratives performed with prosodic prominence and no beat gestures in target positions within the story; and 2) *beat condition*, e.g., narratives performed with prosodic prominence and beat gestures in target positions within the story. Results demonstrated that children who were exposed to the beat training condition showed significant gains in the quality of their posttest narratives of wordless cartoons (e.g. better narrative structure scores and better fluency scores). For Experiment 2, fifty 5- to 6-year-old children performed the same narrative training task as in Experiment 1, under two between-subject experimental conditions: 1) *gesture non-encouraged condition*, and 2) *gesture-encouraged condition*. In the gesture non-encouraged condition, children were just asked to retell the stories without gesture instructions; by contrast, in the gesture-encouraged condition, children were asked to retell the six one-minute stories while producing the beat gestures they had just observed from the narrator. Currently, we are coding the fluency and narrative structure properties of the children's narratives. We hypothesise that encouraging the production of beat gestures will also have positive effects on the short-term narrative discourse abilities.

Keywords: beat gestures; narrative discourse abilities; narrative structure; fluency.

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Cortico-acoustic alignment in cochlear implant users

Anita Wagner[a,b],Natasha Maurits [b,c] & Deniz Başkent[a,b]

[a]*University of Groningen, University Medical Centre Groningen, Department of Otorhinolaryngology/Head and Neck Surgery Groningen, The Netherlands*

[b] *Graduate School of Medical Sciences, School of Behavioral and Cognitive Neuroscience, University of Groningen*

[c] *University of Groningen, University Medical Centre Groningen, Department of Neurology Groningen, The Netherlands*

The entrainment of slow cortical oscillations to the temporal envelope of speech appears to reflect measures of speech comprehension for normal hearing listeners (NH)[1]. For cochlear implant (CI) users, thus profoundly deaf listeners whose hearing sensation is based on the electric stimulation of the auditory nerve, an alignment between the cortical and the speech signal is also a device-induced artifact since the stimulation is based on the time-amplitude envelope of speech. EEG recordings with CI users thus offer the possibility to disentangle the role of the signal versus stimulation on cortico-acoustic entrainment and its linguistic function. We combine measures of cortical-acoustic coherence with behavioral measures of speech processing to investigate how cortico-acoustic alignment relates to speech comprehension by CI users.

EEG recordings of twelve experienced CI users and twelve normal hearing (NH) controls were compared with recordings of twelve NH listeners presented with an acoustic CI simulation (noise vocoded speech). Listeners were presented with 270 sentences. For the first 2s of each sentence we computed the coherence between the acoustic and the cortical signal within the range of 2-20Hz. Recordings of each trial were paired with the amplitude envelope of the sentence presented in this trial and transformed into frequency domain, and cross-spectral density between the acoustic signal and all EEG channels was extracted. The coherence was then pooled across participants and electrode groups. For statistic reference, recordings of each trial were also paired with 100 random sentences.

Overall, the randomly paired signals did not show significant coherence, while the EEG trials paired with respective acoustic signals did. For NH listeners, coherence was found in the theta range (4-8 Hz) for electrodes on the bilateral temporal lobes, and in the delta range (<4 Hz) on midline and frontal electrodes. For NH listeners presented with vocoded speech coherence was smaller in magnitude, both in theta and delta range, and present only on central and left temporal electrodes. For CI user, coherence was overall greater in the theta range on central and temporal electrodes. Coherence in the delta range on midline and frontal electrodes correlated with the individual CI users' performance in behavioral speech comprehension tasks. Individual CI users who were faster and more successful in understanding speech, also showed increased cortico-acoustic coherence in delta range. As assumed for NH listeners, cortico-acoustic alignment found for CI users can represent a measure of active speech comprehension [2], in particular if present on midline frontal electrodes within the delta range (<4Hz). These results confirm also that processing degraded speech leads to smaller coherence, and give support to the thesis that entrainment reflects active processing rather than passive extraction of features from the signal.

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Extraposition of prepositional phrases in language production

Sabrina Weber, Institute of Linguistics, Goethe University Frankfurt

Extraposition of prepositional phrases out of NP is considered to be a marked structure as it splits up the head noun and the dependent PP. Two factors that play a role in the motivation to extrapose are (i) the length of the extraposed constituent (Behagel, 1930; Hawkins, 1994; Wasow, 2002), and (ii) the length of the intervening material (Gibson, 2000; Hawkins, 2014; Temperley, 2007). We report two elicited production studies investigating the influence of the length of both the extraposed PP and the intervening material on the likelihood of extraposition in German. We find that extraposition is favoured over verbal material, with a tendency to drop other intervening material rather than reproduce the extraposed PP in adjacent position. Furthermore, in extraposed position, longer PPs are reproduced.

Experiment 1 investigated whether the length of the extraposed PP influences extraposition rates. Sentences with PPs of three different lengths had to be reproduced (short: 2-3 words, medium: 5-6 words, long: 9-11 words). Results showed a slight, yet insignificant tendency to reproduce extraposed PPs in adjacent position. However, extraposed PPs were significantly longer than PPs in adjacent position. Experiment 2 asked whether extraposition rates were influenced by the length of the intervening material. The head noun and PP were separated by either a verb (1 word), an adverb and verb (2 words), or a PP adverbial and verb (4 words). We found that extraposed PPs were mostly reproduced in target position, however, longer interveners were often shortened to 'verb only' (about 30% in the case of 2-word interveners, and nearly 50% in the case of 4-word interveners). Our findings, therefore, support locality-based accounts, such as Gibson's (2000) Dependency Locality Theory, which predicts that extraposition is favoured over short (one word) distances.

The method used in both experiments was Production from Memory (Bock & Warren, 1985; Bock, 1986), as previous studies (e.g. Tanaka et al., 2011) have shown that canonical structures are reproduced as in the target sentence, while non-canonical structures tend to be reproduced as canonical structures. Thus, extraposed PPs could be expected to be reproduced in non-extraposed position, however, we find this expectation only partially confirmed, therefore putting into question if extraposition is marked in all contexts and conditions.

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Introducing the Artificial Literacy Learning Paradigm for Literacy Acquisition Research

Glenn P. Williams (g.williams@abertay.ac.uk), Nikolay Panayotov, & Vera Kempe
Abertay University, Dundee

It is difficult to compare learning to read and write across orthographical systems (e.g. transparent vs. opaque), input conditions (e.g. dialect vs. no-dialect) or instructional methods (e.g. phonics vs. whole-word reading) because these factors are confounded with linguistic, socio-economic and cultural differences, which can affect opportunities for literacy acquisition. To control for such confounds, we introduce the artificial literacy learning paradigm, which combines miniature artificial language learning with an artificial script (Maurer et al., 2010) to trace learning trajectories for reading and writing.

In our first study, participants learned to read and write 30 artificial mono- and bi-syllabic words using a transparent invented script consisting of 13 graphemes (see Figure 1), which were assembled from 2-4 straight or curved strokes, in analogy to extant orthographic systems (Changizi & Shimojo, 2005). Participants first heard all 30 words one at a time, followed by exposure to the invented graphemes and auditory presentation of the associated phonemes. After familiarisation, they completed three training blocks comprising 10 artificial words each with counterbalanced presentation of reading and writing tasks, interspersed with two more exposure phases, to mimic the alteration of literacy acquisition with every-day language use as it occurs in school children. In the reading task, participants saw a word spelled using the invented graphemes, and had to read it out loud before receiving feedback on the correct pronunciation. In the spelling task, participants listened to a word and had to spell it by clicking on buttons representing each grapheme. During testing, participants were asked to read and spell the 30 training words and an additional 12 novel words without feedback. The procedure is implemented for online presentation and response capture on https://language.abertay.ac.uk/levenik.

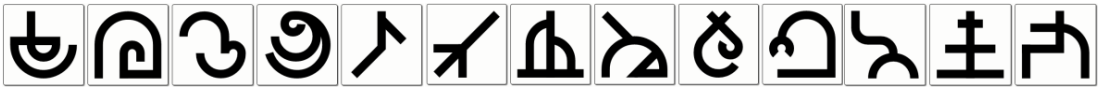


Figure 1. Constructed Orthography used in the Artificial Literacy Learning Paradigm

Preliminary analyses of 23 participants recruited from Amazon Mechanical Turk show that normalised Levenshtein Edit Distance (nLED) to the target dropped from an average of 0.62 during the first block to 0.38 during testing for reading and from 0.62 to 0.41 for spelling but increased for novel words to 0.46 for reading and 0.46 for spelling. For trained words, performance during testing was significantly better for reading than writing, suggesting a role for direct lexical retrieval in addition to grapheme-phoneme conversion. These data show that artificial literacy learning lends itself well to the controlled study of reading and writing acquisition in parallel, to explore literacy acquisition in transparent vs. non-transparent orthographies, as well as in situations with and without dialect exposure. In the future, we plan to make script and language construction algorithms freely available to encourage more controlled studies of literacy acquisition.

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Electrophysiological correlates of the "L1 after L2" slowing effect. Evidence for the reduced activation account.

Zofia Wodniecka, Jakub Szewczyk, Patrycja Kałamała, Paweł Mandera, Joanna Durlik
Jagiellonian University, Krakow, Poland

Speech production in L1 is slower when it follows a block of L2 production (*L1 slowing effect*; e.g. Misra et al., 2012; Branzi et al., 2014). However, the exact nature of this effect is not well understood. Previous studies reported N2 associated with the slow-down and proposed that L1 is inhibited after language production in L2 (e.g. Misra et al., 2012).

Here, we explored neural correlates of the behaviorally observed slow-down in a blocked language naming paradigm. 71 native speakers of Polish (L1) who were learners of English (L2), completed a picture naming task. The task consisted of four blocks: 1) picture naming in L1; 2) picture naming in L1; 3) picture naming in L2; 4) picture naming in L1. In Block 1) and 3) all presented pictures were completely new, whereas in Block 2) and 4) half of the pictures were completely new (*new condition)* and half were repeated from the preceding block. In Block 2, the repeated pictures were named in L1 after they were named in L1 (*congruent condition*), while in Block 4, the repeated pictures were named in L1 after they were named in L2 (*incongruent condition*).

We compared RTs and ERP responses for L1 naming in Blocks 2 and 4, across the different conditions. L1 naming latencies were slower for all pictures (both *new* and *incongruent*) named after the block of L2 naming, compared to L1 naming occurring after the block in L1. This behavioral effect was accompanied by a modulation of a centrally distributed negativity in the 200-500ms time-window which we identified as the N300 component: the amplitude of the N300 was larger for all pictures named in L1 after the block of L2 naming. Moreover, repeated pictures in the *congruent* condition were named much faster than pictures in the *new* condition. This was accompanied by a large reduction in the amplitude of the N300 component. Thus, the N300 amplitude was graded: highest for conditions of L1 naming following L2 block, and the smallest for the condition where L1 naming followed L1 naming of exactly same items. It appears therefore, that the magnitude of the N300 amplitude is linearly related to the level of language and item overlap: the greater the overlap (or consistency), the smaller the N300 amplitude. Notably, no N2 was obtained.

Overall, the results suggest that after a block of naming in L2, activation of all lemmas in L1 is reduced, but there is no clear inhibitory process accompanying the L1 naming after the L2 naming.

Branzi, F. M., Martin, C. D., Abutalebi, J., & Costa, A. (2014). The after-effects of bilingual language production. *Neuropsychologia*, *52*, 102-116.

Misra, M., Guo, T., Bobb, S. C., & Kroll, J. F. (2012). When bilinguals choose a single word to speak: Electrophysiological evidence for inhibition of the native language. *Journal of Memory and Language*, *67*(1), 224-237.

Individual cognitive skills in relative clause production and comprehension

Shihui Wu, Silvia Gennari & Lisa Henderson, University of York

Previous studies suggest that the animacy of the head noun in relative clauses (RCs) modulates processing cost in comprehension and utterance choice in production. Specifically, animate-head active phrases (e.g. the girl that the boy is kicking) are more difficult to comprehend and more infrequent in production, compared to inanimate-head active phrases (e.g. the ball that the boy is kicking)[1][2]. It's argued that conceptual similarity between the RC nouns (boy, girl) plays a role in production and comprehension: comprehenders experience greater semantic interference or competition when encountering highly similar nouns, leading to longer reaction times (RTs); and speakers prefer passive RCs instead of active RCs to mitigate such competition.

Here we examined whether individual cognitive abilities predict performance in RC production and comprehension. In particular, the similarity-based competition account above suggests that individual skills associated with cognitive control such as inhibition skills should explain individual differences. 67 adults completed picture-based tasks measuring RC comprehension and production, with 8 additional tasks assessing other cognitive skills (vocabulary, semantic inhibition, stroop, digit span, stop-it, etc.). The semantic inhibition task involved suppressing prepotent (high-frequency) responses to ambiguous words in favour of low-frequency alternatives.

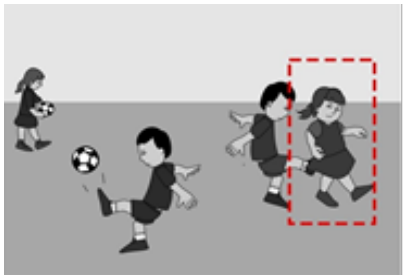


Figure 1: Example of picture stimulus

The main experimental tasks showed a scene like that of Figure 1 for 3 seconds. Then, a square appeared (as shown), and participants were asked to either verbally described the character highlighted (production), or were asked to indicated whether the auditorily presented active description (e.g., the girl the boy is kicking) was correct. Structure choice and fluency (utterance duration/number of phonemes) were measured for production, and RTs for comprehension.

Results for the production and comprehension tasks replicated previous findings: More passive structures were produced for animate-head RCs (e.g., the girl being kicked) than inanimate-head ones. In comprehension, active animate-head RCs took longer to respond than active inanimate-head RCs. Critically, hierarchical regression models indicated that individual performance in the semantic inhibition task and vocabulary measures both significantly explained individual differences in RC comprehension and production: the poorer the inhibition across participants, the longer the comprehension RTs and the larger the choice of passives in production, whereas better vocabulary correlated with faster RTs and better production fluency.

The results suggest that both semantic inhibition and vocabulary knowledge are key aspects of efficient RC comprehension and production, suggesting that inhibition skills and good quality lexical representations underpin competitive processes in production and comprehension. We will discuss how these two factors play a role in RC production and comprehension, and in particular, how they contribute to competition resolution.

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Modality-Related Issues in the Processing of Morphologically-Complex Words

Hilary Wynne[1], Beinan Zhou[1], Sandra Kotzor[1,2], & Aditi Lahiri[1]
[1]*University of Oxford*, [2]*Oxford Brookes University*

Representation and access of morphologically complex words remains controversial (cf. Amenta & Crepaldi, 2012). Although there is increasing evidence that morphological decomposition plays a role in language comprehension, the processing of affixed words is not yet well understood. Factors which have been investigated include direction of processing (Marslen-Wilson et al., 1994), frequency effects (Colé et al., 1989), and modality (Feldman & Larabee, 2001). The present research focuses on the question of how modality and affix position affect the processing of complex words during language comprehension.

Using Bengali, which has rich derivational morphology, we conducted two types of priming tasks (cross-modal and visual delayed). In a cross-modal task, hearing a stem will affect the visual recognition of an affixed target (and vice versa). If the target is a prefixed item, the prefix must be stripped before the stem is accessed. In a suffixed target, however, the stem is immediately accessible. We therefore predict that prefixed targets will elicit stronger priming effects than suffixed targets when preceded by a stem prime.

Visual delayed priming tasks remove effects of orthographic facilitation in morphologically-related primes and targets (Feldman & Bentin, 1994). Here we predict that seeing a stem will also affect recognition of an affixed target (and vice versa). Following results from English (Feldman & Larabee, 2001), we also predict that absence of the auditory prime will have cohort-related consequences for the processing of affixed targets.

We include three priming conditions which cover a full range of derivationally-complex (semantically related) Bengali items (see Table 1).

Table 1. Design and results for morphological related conditions (⇔ indicates in both directions)

	Cond 1	**Cond 2**	**Cond 3**
Structure	stem ⇔ prefix	stem ⇔ suffix	prefix ⇔ suffix
Prime	aʃa *hope*	dɔea *compassion*	ɔ-bitʃar *in-justice*
Target	dur-aʃa *without hope*	dɔealu *compassionate*	bitʃar-ok *judge*
Stem	aʃa *hope*	dɔea *compassion*	bitʃar *judge-ment*

All conditions showed significant morphological priming. The cross-modal experiment showed significantly greater facilitation in the prefix -> stem condition than for suffix -> stem pairs. In addition, stem -> suffix resulted in shorter response latencies than stem-> prefix. In the delayed priming task, there was no difference in facilitation between the stem->suffix and stem->prefix conditions and response latencies were not significantly different across conditions.

While the asymmetric results of the cross-modal task are in line with uniqueness-point predictions made by, for example, the Cohort model (Gaskell & Marslen-Wilson, 1997, 2002) due to activation of both the morphological and phonological cohorts, this effect is not present in the purely visual delayed priming data. This suggests that phonological cohort effects degrade or d*isappear* in the visual task. The role of the morphological and phonological cohorts during visual word recognition in difference modalities is discussed (cf. also Feldman & Larabee, 2001).

How do speakers grammatically encode conceptually prominent information?

Fang Yang, Martin Pickering, Holly Branigan,
The University of Edinburgh

Our conversational partners often easily recognise prominent information that we intend to draw their attention to. For example, hearing utterances (1) '*It was Beckham whom Obama kicked*' or (2) '*Beckham, Obama kicked him*', they understand that the prominent entity in our mind is the patient (Beckham; focus in (1) and topic in (2)). But how do we manage to make such information easily recognisable? Our study investigates how people encode conceptual prominence in real-time sentence production. Previous research showed that speakers tended to assign prominence to the patient (encoding the patient as the sentence-initial subject of a passive sentence) after hearing their interlocutors highlighting the patient as focus in previous utterances [1]. Do speakers also tend to assign prominence to the patient after hearing their interlocutors highlighting the patient as topic? Moreover, do they grammatically encode such prominence via word order, grammatical function assignment, or both? To investigate these questions, we tested 87 Mandarin speakers in two confederate-scripted priming experiments. Mandarin realises patient-prominence via four non-canonical structures ((3)-(6)) where the patient bears different grammatical functions (topic in (3)-(4), subject in (5) and object in (6)) but is always encoded earlier in the sentence than in the canonical SVO order (7).

(3). Topicalisation (TOP): ***Beckham,*** *Obama ti-dao le.*
(4). Left-dislocation (LDT): ***Beckham,*** *Obama ti-dao le ta.*
(5). *Bei*-structure (BEI): ***Beckham*** *bei Obama ti-dao le.*
(6). *Ba*-structure (BA): *Obama ba* ***Beckham*** *ti-dao le.*
(7). Canonical SVO: *Obama ti-dao le* ***Beckham****.*
Ti-dao (kick-fall); *le* (aspect-marker); *ta* (him); *bei* (passive-voice-marker); *ba* (*Ba*-construction-marker)

In both Experiment 1 (picture-describing-and-matching task, N=48) and Experiment 2 (picture-questioning-describing-and-matching task, N=39), confederates produced a scripted TOP, LDT, SVO, or intransitive (baseline) prime description in each trial. In Experiment 1, participants produced more patient-prominent BA responses after a TOP (24.6%) or LDT prime (20.0%) than an SVO prime (12.0%; p <.001). In Experiment 2, they produced more patient-prominent (BA, BEI, TOP, LDT) responses after a TOP (22.2%) or LDT prime (16.3%) than an SVO prime (13.4%; p <.01). Taken together, these results cannot be explained through repetition of animacy, thematic-role order, or syntax. Thus we conclude that speakers tend to persist in assigning prominence to particular thematic roles across utterance. Given that the prominent patient was encoded in non-canonical positions in both patient-prominent primes and patient-prominent responses, and given that its grammatical function differed in these primes (topic) and in patient-prominent BA responses (object), we conclude that after identifying the prominent thematic role speakers encode it via non-canonical word order independent of grammatical function assignment. Overall, our results demonstrate that people conceptualise prominence during message encoding and in doing so are influenced by the information status of entities (i.e. topicality) in previously-encountered utterances. They then grammatically encode such conceptual prominence by manipulating the order of to-be-mentioned entities in real-time production.

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"She Sells Seashells": Direct Speech Quotations Promote Tongue-Twister Effects In Silent But Not Oral Reading

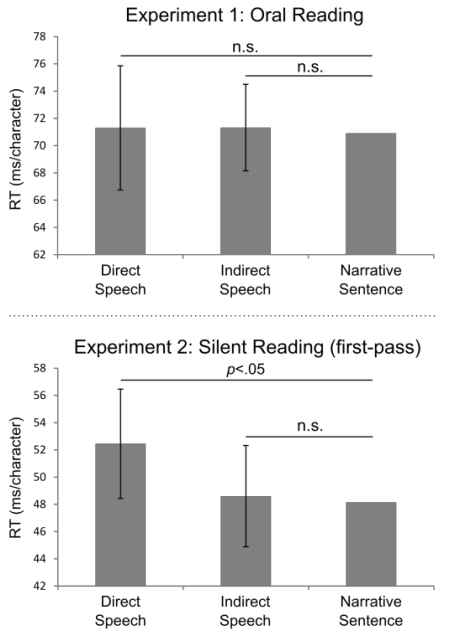
Bo Yao
Division of Neuroscience and Experimental Psychology, University of Manchester, UK

Research has shown that people are more likely to hear an "inner voice" during silent reading of direct speech quotations (e.g., *Mary said: "This dress is beautiful!"*) as opposed to indirect speech sentences (e.g., *Mary said that the dress was beautiful*) [1]. Such "inner voices" reflect the temporal characteristics of actual speech [2] and may contain prosodic representations [3].

The current research examined whether such "inner voices" also contained phonological representations. Participants read 24 short stories either orally (Experiment 1, *N*=12, with audio recording) or silently (Experiment 2, *N*=63, with eye-tracking) for comprehension. Each story contained a tongue-twister critical sentence (e.g., *She sells seashells by the sea shore*) that was reported in a direct speech, an indirect speech or a narrative sentence (Reporting Style).

Reading times per character (RT/char) on critical tongue-twister sentences were modelled using maximal linear mixed models. We found no effects of Reporting Style in oral reading, *b*s<.42, *t*s<.26. In silent reading, RT/char (first-pass reading) was significantly longer in direct speech than in narrative sentences, *b*=4.29, *t*=2.10, *p*<.05, but was statistically indistinguishable between indirect speech and narrative conditions, *b*=.45, *t*=.24 (**Figure 1**).

Figure 1: Estimated Reading Times by Character



Note: error bars indicate the 95% confidence intervals of the contrasts

The results demonstrated more pronounced phonological activation (i.e., visual tongue-twister effects [4]) in silent reading of direct speech quotations. This difference disappeared in oral reading when phonological representations were fully activated. It sheds new light on the nature of "inner voices" in silent reading of direct speech and suggests that "inner voices" may indeed contain phonological representations.

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Ordering French binominals: frequency or linguistic constraints?

Aixiu An Anne Abeillé Benoît Crabbé
Laboratoire de Linguistique Formelle, University of Paris Diderot

Ordering of binominal expressions (*N1 and N2*) has raised many discussions (e.g., Malkiel 1959, Cooper and Ross 1975, Benor and Levy 2006…). Different constraints have been proposed but few based on large corpus data. Benor and Levy (2006) and Mollin(2012) propose a multifactorial analysis with a hierarchy of semantic and phonological constraints for English. More recently, Morgan & Levy (2016) argue that direct experience (the overall frequency) largely overrides linguistic constraints both in an offline task and an online task, suggesting that such expressions may be stored without being analysed.

Binominals have not been studied for French so far. Using *frWac* (Baroni et al. 2009, 1.6 billion words), we extracted 96 612 types (371 000 tokens) relying on Det omission, using the pattern *Det N1 et N2 (votre nom et prénom 'your name and first name'; les père et mère 'the father and mother'…)*, and retained 54 660 types (196 496 tokens) after removing noise. We annotate N1 and N2 for word frequency and five linguistic constraints: length, gender, animacy, syllable openness and hiatus, using *Glaff* (Sajous et al 2013).

The ***relative frequency*** of binominals is calculated as the overall frequency of construction *Det N1 et N2* divided by the overall frequency of construction *Det N1 et N2* plus *Det N2 et N1*. There is a significant effect of predictor *frequency* for relative frequency in a logistic regression model ($p<.0001$), which means, the more frequent the binominal expression, the more likely fixed its order.

For a logistic regression model (*glm* function in R), we coded constraints as 1 when they favour alphabetic order, -1 when they disfavour, 0 when they are not active. The outcome is coded 1 if the binominal expression appears in alphabetical order and 0 otherwise. The dependant variable is a binomial word order where success states that alphabetical order equals observed order. Each constraint is entered as a predictor, with no interactions between constraints (table 1).

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.028457	0.008848	3.216	0.001299 **
length	0.408021	0.011996	34.013	< 2e-16 ***
frequency	0.033421	0.009049	3.693	0.000221 ***
openness	-0.015880	0.013961	-1.137	0.255339
gender	-0.070905	0.014848	-4.775	1.79e-06 ***
animacy	-0.293216	0.053137	-5.518	3.43e-08 ***
hiatus	-0.087921	0.015079	-5.831	5.52e-09 ***

Table 1. Constraint weights in our probabilistic model

The model correctly predicts the ordering preferences for 57% types. We have annotated four additional semantic constraints (power, iconic, perceptual markedness, formal markedness) for 100 randomly chosen types, and the model accuracy has risen to 79%, and more types will be annotated in the next step.

In a new logistic regression model with binomial word order as the dependent variable linguistic constraints (our model (table1)'s predicted probability) and relative frequency as predictors, we see a significant effect of relative frequency ($p<.0001$) and linguistic constraints ($p<.0001$).

Conclusion: Frequency is an important factor in predicting binominal order. First of all, it correlates with the reversibility of the binominals. Moreover, we find that both linguistic constraints and relative frequency play a role in ordering French binominals, which is compatible with the result of Morgan & Levy (2016) for English binominals.

Cross-linguistic influence in the processing of complex noun phrases by L2 speakers of English

Shanley Allen[1], Leigh Fernandez[1], Mary Elliott[2], Neiloufar Family[1], Kalliopi Katsika[1], Maialen Iraola Azpiroz[1], Juhani Järvikivi[3] , & Lianna Fortune[3]
[1]University of Kaiserlautern, [2]Northeastern University, [3]University of Alberta

Complex noun phrases (CNPs), composed of a head noun plus several modifiers, are one of the hallmarks of academic texts. CNPs help with succinct and efficient concept naming (e.g. *pharmaceutical market size increase*), but understanding them often requires technical knowledge or previous set-up in the discourse (e.g. Biber, et al., 2010). Off-line studies have found that CNPs cause more processing difficulties in paraphrasing and definition recognition than their prepositional phrase (PP) counterparts (e.g., *increase in the size of the pharmaceutical market*) (e.g. Limaye, et al., 1991).

In the present study, we investigated whether CNPs lead to on-line processing difficulty. Based on previous off-line research, we predicted that CNPs would be harder to process than PP constructions, and that this would be more pronounced for longer structures. We compared eye movements during reading between three groups: (1) native speakers of English, (2) native speakers of German, and (3) native speakers of Spanish or Portuguese. The two groups of L2 speakers were advanced English speakers, allowing us to test for cross-linguistic influence by comparing speakers of an L1 that commonly uses CNPs (German) and an L1 that uses connectors to join elements of a phrase (Spanish and Portuguese).

Two variables were manipulated: *Structure* and *Words*. *Structure* comprised either a CNP (NP) or the equivalent structure with modifiers expressed as prepositional phrases (PP). *Words* is the number of words in the CNP: four (Four) or six words (Six). Total reading times in the post-critical (following the CNP/PP) region for both the Four and Six conditions showed that L2 speakers had longer reading times compared to native speakers. Critically, the Spanish/Portuguese group showed significantly longer reading times in the NP compared to PP conditions, while the English and German speakers showed no such differences. The length manipulation showed no consistent pattern, and more research is needed.

This suggests that overall, CNP structures were more difficult to process than PP variants (Post-critical region). Participants whose L1 has no CNPs were slower to process NP constructions than participants whose languages have CNPs, demonstrating a clear cross-linguistic influence.

Biber, D. & Gray, B. (2010). Challenging stereotypes about academic writing: Complexity, elaboration, explicitness. *Journal of English for Academic Purposes*, *9*, 2-20.

Limaye, M., & Pompian, R (1991). Brevity Versus Clarity: The comprehensibility of nominal compounds in business and technical prose. *The Journal of Business Communication, 28*, 17-21.

Does predictability affect reference form? Only for highly predictable thematic roles

Jennifer Arnold; Kathryn Weatherford; Sandy Zerkle; Elise Rosa (UNC Chapel Hill)

Researchers debate whether predictability affects pronoun production. Several theories propose that predictable information is linguistically reduced (Jurafsky, 1996; Levy & Jaeger, 2007; Mahowald et al., 2013). This suggests that predictable references should be pronominalized, but evidence is mixed. Some thematic roles are more likely to be mentioned again in the subsequent discourse, leading to "next-mention predictability". For example, in transfer verbs, e.g. *Ann sent letters to Sue,* or *Sue received letters from Ann*, the goal (Sue) is more likely to be mentioned in the next sentence (Stevenson et al., 1994). Likewise, in implicit-causality events with psych verbs, like *Ann admired Sue because…*, or *Sue impressed Ann because…,* Sue is perceived as the implicit cause of the event, and is more predictable. But predictability has inconsistent effects on reference form. In transfer events, speakers tend to use pronouns for goals more than for sources (Arnold, 2001; Rosa & Arnold, 2017). But in psych verbs there is no preference to pronominalize the implicit cause (Fukumura & van Gompel, 2010; Kehler et al., 2008; Rohde & Kehler, 2013; Kravtchenko et al., 2017). Understanding this mismatch is critical for testing theories about predictability in production. We tested three hypotheses.

Hypothesis 1: The failure to find predictability effects for psych verbs stems from the use of the sentence continuation methodology. In a more naturalistic novel fact-memorization paradigm, participants learned facts about the characters, then read a context, such as *The driver and the duke took a short cut to town. The driver amazed the duke because….* Participants then produced the best explanatory fact, e.g. *{He/ The duke} was bad with directions.* Yet we found **no difference** in the rate of pronoun use for implicit cause vs. noncause characters. Similar results were found in another experiment. This reinforces the contrast between transfer and causal contexts.

Hypothesis 2. The predictability of implicit causes changes over time. Speakers often pre-plan their speech, perhaps selecting a pronoun during the preceding sentence. If the causal relation between utterances is not active yet, it may not influence referential form choice. We showed participants the context sentences for the experiment and asked them to predict who would be mentioned next. Participants were more likely to choose the implicit cause when the fragment included the word "because" (78%) than when it didn't (61%). Thus, the implicit cause may not be highly predictable when pronouns are planned.

Hypothesis 3. Predictability in experiments may not reflect frequency of re-mention in the real world, which also signals predictability. We analyzed transfer and psych verbs from the Fisher corpus, asking which entity was mentioned again in the next sentence. The predictable referent was mentioned more frequently in transfer verbs (goals), but not in psych verbs (implicit causes); see Fig. 1.

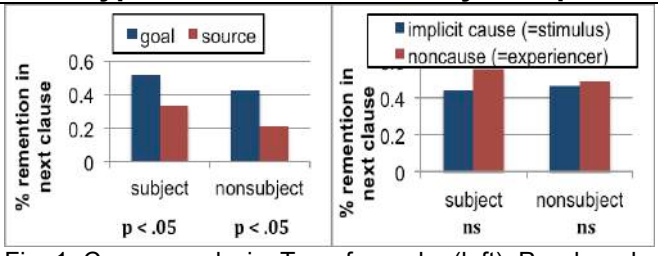


Fig. 1. Corpus analysis: Transfer verbs (left); Psych verbs (right)

In sum, new evidence confirms that predictability does not affect pronoun production in implicit causality scenarios, which contrasts with findings from transfer events scenarios. A rating study and a corpus analysis suggest that implicit causes may not be perceived as predictable early enough or strongly enough to influence reference production.

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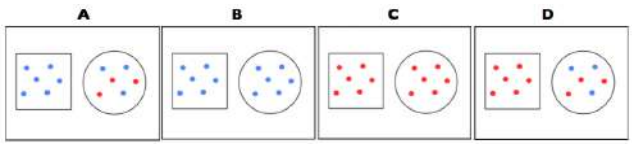
Why your mates are relevant – ERP evidence on the impact of lexical alternatives on on-line implicature processing in German

Petra Augurzky & Michael Franke, University of Tübingen

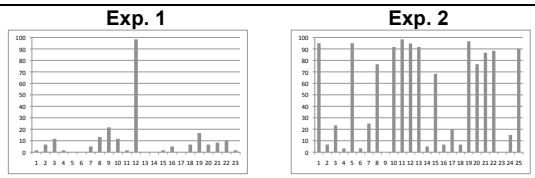
Current studies suggest that the on-line processing of pragmatic information may be postponed after an initial step in which the literal meaning of a message has been calculated. For instance, delayed pragmatic effects of inference generation have been observed for sentences involving the quantifier *some* (Huang & Snedeker, 2009, Noveck & Posada, 2003). However, processing delays may depend on the contextual availability of lexically realized alternatives like number terms (Grodner et al., 2010, Degen & Tanenhaus, 2015).

The present ERP study examines whether the felicity of the pragmatic, non-literal reading of *some* (*some but not all*) is similarly driven by the explicit contextual availability of its scale mate *all*. To date, neurolinguistic studies show heterogeneous results with respect to time course, processing cost and ERP correlates of implicature processing (Spychalska & Werning, 2016). In two studies, we examined the processing of German versions of sentences like *Some dots are blue that are in the circle/square* preceded by pictures. In *Exp. 1* (n=23), we exclusively presented sentences containing *some*, and in *Exp. 2* (n=25), 50% of the sentences included the quantifier *all* as fillers. We examined implicature processing over the course of the utterance by comparing ERPs on the quantifier and later sentential positions, i.e. the adjective and the shape noun, the latter position contrasting a pragmatic (A: *square* vs. *circle*) and a semantic (D: *square* vs. *circle*) mismatch.

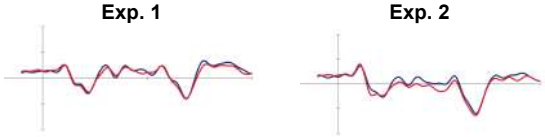
We found that implicature processing related to *some* is modulated by the presence or absence of its lexical alternative *all*, comparably to number terms: First, behavioral responses in Exp. 1 show a strong preference for the literal reading, but in Exp. 2, half of all participants exhibited a pragmatic preference. Second, only in Exp. 2 did ERPs from quantifier onset reveal a positivity for the pragmatically infelicitous reading (i.e. *some* preceded by contexts B,C vs. A,D). This effect may be associated with increased processing costs due to the establishment of a subset reading (Kaan et al., 2006). In both studies, ERPs from adjective onset showed a graded pattern, with the strongest N400 for semantic violations (C), and the most reduced effects for literally true conditions (B, see Augurzky & Franke, 2016, for a prediction-based account). Finally, pragmatic mismatch effects on the shape noun were restricted to Exp. 2. Whereas conditions did not differ in Exp. 1, an interaction between PARTICIPANT GROUP, CONTEXT and SHAPE NOUN was found, showing a biphasic N400/600 pattern for both mismatches for pragmatic responders, whereas this pattern was restricted to semantic mismatches for semantic responders. Our results replicate previous behavioral findings on the impact of lexical alternatives and are compatible with context-dependent approaches on implicature processing (Degen & Tanenhaus, 2014).



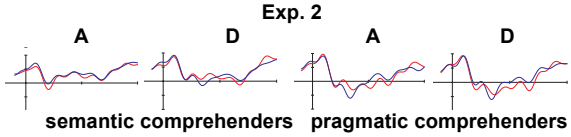
Example of pictorial contexts



Percentages of pragmatic responses for each participant



ERPs from the onset of the quantifier: simple contexts (red, B+D) vs. complex contexts (blue, A+C)



ERPs from the onset of the shape noun: matching shape (blue, *circle*) vs. mismatching shape (red, *square*)

Eye movements and acoustic evidence reveal behavioural differences between poetry and prose reading

Stefan Blohm[1,2], Stefano Versace[1,3], Sanja Methner[1], Valentin Wagner[1]
[1]Max-Planck-Institute for Empirical Aesthetics, Frankfurt
[2]Johannes Gutenberg University, Mainz
[3]University of Birmingham

When encountering instances of a genre, experienced readers rely on schematic text type representations that guide their reading behaviour (e.g., van Dijk & Kintsch, 1983). Strong empirical support for hypothesized genre-specific reading modes stems from studies that contrasted the silent reading of identical but differently categorized texts (e.g., Schumacher & Avrutin, 2011; Zwaan, 1991). Acoustic analyses of spoken poetry and prose texts further unveiled genre-specific performance and intonation styles (e.g., Barney, 1999). Combining these approaches in a within-participants design, we used eye movements and acoustic analyses to examine global and local effects of genre on comprehension and production during oral reading.

Thirty-two participants orally read short texts while their eye movements and their voices were recorded. Identical texts were presented in either a prose or in a poetry layout. Furthermore, each text contained a sentence-initial sequence of two monosyllabic function words, which are typically unstressed, and thus served as critical region at which imposition of metrical accent should become manifest. Critical regions were either preceded by a (metrical) context sentence or not. We expected (1) a general slow-down for poetry vs. prose reading, and that (2) the degree of stress assigned to critical words varies as a function of genre categorization, if imposition of metrical accent is top-down-driven by the text type schema, and of prosodic context, if imposition of metrical accent is bottom-up-driven by (cross-sentential) prosodic priming.

Confirming hypothesis (1), global eye-movement and acoustic measures showed reduced reading rates as well as more fixations and pauses during poetry versus prose reading. Regarding hypothesis (2), we found that acoustic correlates of word stress were differently affected by the context and the genre manipulations: Independent of the genre, the presence of a preceding context sentence generally decreased the pitch (F0) (and the fixation probability) of the critical region, most likely reflecting the absence/presence of a discourse-pragmatic context. Genre, in contrast, modulated the relative duration of the critical words, leading to more pronounced realization of an alternating rhythm pattern in the poetry than in the prose condition.

Our findings replicate and extend previous support for the genre-specific reading hypothesis by relating comprehension and production measures for poetry vs. prose reading by non-experts. Our results further question the notion of the metrical template as a feature of the text, and suggest functional differentiation of articulatory means in text performance.

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Guided reading: Using corpus methods to investigate how teacher strategies differ across children's reading ability, SES, and teacher experience.

Liam Blything, Andrew Hardie, and Kate Cain (Lancaster University, UK)

Guided reading is used widely in literacy classrooms. Although previous research has demonstrated the effectiveness of many of the techniques used in guided reading (e.g., Taylor, Pearson, Clark, & Walpole, 2000), teachers demonstrate a lack of awareness of the specific language strategies that should be used for applying those methods (Ford, 2015). This paper aims to use large-scale corpus methods in order to identify the fine-grained language features used by teachers during guided reading sessions; and also to examine how these features vary according to children's age, reading ability, SES, and teacher experience.

We collected a corpus of teacher-child interactions during guided reading sessions, approaching 500,000 words. The corpus represents recordings of 95 sessions that each typically lasted between 15 and 35 minutes. Recordings aimed to be non-invasive to the normal proceedings of a session. Teachers (N = 22) and children (N = 119; aged 5 to 11 years) were from school districts serving different socio-economic status. The language features of teacher input are analysed using the corpus tool CQPweb (Hardie, 2012). Much of this process draws concurrent work that successfully created a set of corpus queries which can identify a range of question types that may be involved in eliciting different types of responses by children (Smith, 2016). Background measures were taken of children's reading ability, and teacher experience.

We present corpus analyses demonstrating that teachers of younger children ask a higher proportion of wh-questions per 1000 words spoken relative to teachers of older children. We will also present how this has been followed up with a more fine-grained analysis of specific wh-question types that can be organised onto a continuum from low challenge questions that might be more likely to constrain responses (e.g., wh-determiners: *which, what, whose*; wh-pronoun: *who*) to high challenge strategies that might be more likely to elicit evaluative responses (e.g., wh-degree-adverbs: *where, when, why, how*). Although our follow up analysis is preliminary, it suggests that the initial finding (that teachers of older children ask less wh-questions) is not driven by a decrease in any specific wh-question type. This may highlight the limited extent to which teachers consider the use of specific wh-question types for eliciting different types of responses by children. In addition, data are being explored in relation to SES and teacher experience.

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Developing productive skills through implicit learning

Giulia Bovolenta (University of Cambridge)
John N. Williams (University of Cambridge)

"Implicit learning" is the process through which we can incidentally learn a regularity while remaining unaware of what we have learnt. The application of implicit learning paradigms to second language acquisition research has shown that implicit learning can occur with a variety of linguistic features including novel form-meaning connections. However, these studies usually test for the development of implicit knowledge with comprehension tasks only; they do not check whether participants demonstrate sensitivity to the rule in production, even though this is a fundamental aspect of language acquisition.

To address the question, we ran two experiments in which participants were exposed to a novel rule based on Czech spatial prepositions *v* and *na,* which both mean "in, at" but alternate chiefly according to the type of place described by the noun (open vs. bounded space). Participants heard Czech sentences with English lexis in which prepositions were replaced by one of four pseudowords (gi, ro, ul, ne; e.g. "Mary is gi supermarket"). Each sentence was accompanied by a graphic representation consisting of a picture of the place named in the sentence, together with a drawn character. The four prepositions were divided into two pairs: one pair was used when the character was inside the picture, the other pair when the character was outside the picture. Participants were encouraged to discover this association. However, there was a further Place Type rule that they were not told about: when the character was inside the picture the specific preposition used (out of a possible two) depended on whether the place was an open or bounded space (System condition). When the character was outside the picture the two possible prepositions were used interchangeably for different types of place (Random condition).

The exposure phase consisted of a short-term recall task in which pictures and auditory descriptions were presented in sets of 4 (Expt 1) or 2 (Expt 2) followed by oral recall cued by each picture. The testing phase involved longer-term cued recall and production. In Expt. 1, participants heard the training sentences in blocks of 8, and were asked to recall them at the end of each block with the aid of the relevant pictures. In Expt. 2, no further exposure was given; participants only saw the pictures and had to produce appropriate sentences. To test for generalization, a small number of novel generalisation items were intermixed with the training ones (in Exp. 2 only). Awareness of the Place Type rule was assessed by verbal report at the end of each experiment; the data reported are from participants who remained unaware of Place Type rule throughout the experiment (and who, in Expt. 2, were also unaware that the generalisation items were novel).

In Expt. 1, overall accuracy (i.e. whether a subject produced the correct preposition out of the possible four) was significantly higher for the System condition than the Random condition, suggesting that the Place Type rule had a facilitatory effect. In Expt. 2, the effect emerged over time: in the last 3 blocks of the testing phase overall accuracy on training and generalisation items combined was significantly better for System than Random items, and within-condition accuracy for System items (the proportion of correct use of propositions from the System pair when seeing System items) was significantly above chance. Performance in the Random condition was at chance suggesting no rote memory for actual prepositions. The results suggest that implicit rule knowledge gained through cycles of comprehension and short-term recall can transfer to a production task. Our next step will be to see whether this knowledge can also be evident in free production tasks that are not masquerading as recall tasks.

Evidence for accommodation and assimilation in L2 learners

Brice, Henry[1], Mencl, W. Einar[2], Frost, Stephen[2], Rueckl, Jay[2,3], Pugh, Ken[2,3] & Frost, Ram[1,2].

[1]The Hebrew University of Jerusalem

[2]Haskins Laboratories

[3]University of Connecticut

This study presents preliminary data from Time 1 of a longitudinal neuroimaging study of second language (L2) acquisition. The study is tracking a cohort of English speaking immigrants to Israel, learning Hebrew as an L2. English and Hebrew are contrasting languages having alphabetic writing systems that differ substantially in how the phonological properties of words are represented by their written forms, and especially in the morphological structure of words. Similarities and differences in the statistical properties of the English and Hebrew orthographies are also well-documented. The results shown here are from an fMRI paradigm which looked at processing of words in both L1 and L2, in both auditory and visual modalities. Subjects performed an animacy judgement test in order to ascertain full lexical access.

Perfetti and colleagues (2007) suggest that the neural signature of L2 reading can be described as a process of accommodation in which L1 circuits converge with reading circuitry in L2, or an assimilation process of L1 circuits differentiating from L2 processes. Preston et al. (2015) similarly show that a convergence of print and speech processing predicts reading ability in early readers. We look at the overlap of L1 and L2 processing and the overlap of print and speech processing in both L1 and L2, and its relation to both L1 and L2 fluency and proficiency.

Preliminary results point to print and speech accommodation in the bilateral Fusiform Gyrus (FFG), also termed the visual word-form area, typically tied to orthographic processing. with higher L2 proficiency correlated with greater accommodation.

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Accents and Focus Particles Draw Attachment

Katy Carlson, Morehead State University

There is growing evidence that pitch accents can affect syntactic attachment in ambiguous sentences (Schafer et al. 1996; Lee & Watson 2011; Carlson & Tyler 2015). In sentences like (1), contrastive L+H* accents on the first verb (*learned*) or the second verb (*arrived*) increased attachment of the final adverbial phrase as a modifier of the accented verb. But is that effect due to an accented word being salient and memorable, or due to an accented word indicating focus position? Two experiments support a focus-based explanation, on which the focus status of the accented word makes it important to the main sentence assertion and thus draws attachment (Schafer et al. 1996).

In Experiment 1 (N=52), 20 wh-questions like (2) had contrastive accents on Verb1 (*say*) or Verb2 (*hurt*), and a small prosodic boundary after V1 or not. Participants chose between answers with low (V2) or high (V1) attachment *(Laura said it on Tuesday/hurt it on Tuesday)*. The highest V1 attachment rates (62%) were found with V1 accent and a prosodic boundary; the lowest (42%), with V2 accent and no boundary. The boundary effect replicates findings that attachment is harder across a prosodic boundary than within a prosodic phrase (e.g. Watson & Gibson). The accent effect extends attachment research to structures where the ambigous phrase precedes both possible attachment sites. If accent effects are due to better memory for accented attachment sites (salience), then it is not clear that this explanation would extend to structures with this order; the focus hypothesis explains these results as easily as other structures.

In Experiment 2 (N=52), 20 sentences like (3) had the focus particle *only* before V1 (*learned*) or V2 (*arrived*); two further conditions accented the verb with the particle. Participants chose between paraphrases showing V1 or V2 attachment. *Only* on V1 led to over 60% V1 attachments; *only* on V2 led to 35% V1 attachments. Accents on either verb raised V1 attachments very slightly. If focus is the mechanism behind accent attachment effects, then other means of focusing words, such as focus particles, should have similar effects. A salience theory might lead to the same conclusion, but via less direct reasoning (the particle focusing the verb makes it salient). The non-significant effect of accent here suggests that focus from one indicator makes another one redundant in this structure.

This research extends accent effects on attachment to wh-questions and shows that focus particles can also draw attachment, supporting a focus-based explanation for both. Even in sentences not thought to be focus-sensitive, the information structure of the sentence as reflected in accent position can have important consequences for syntactic structure.

(1) Susie learned that Bill had arrived # on Friday.
(2) When did Laura say that she hurt her ankle?
(3) Susie (only) learned that Bill (only) arrived # on Friday.

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Memory in the processing of anaphoric presuppositions

Sherry Yong Chen & E. Matthew Husband
University of Oxford

Anaphoric presupposition triggers such as *again* are thought to establish a dependency relation between the trigger and its presupposed content [1]. Like other dependencies, establishing presuppositional dependencies relies on memory processes. While discourse content may be **actively maintained** in working memory, previous experimental work suggests that the processing of presuppositions exhibits a locality bias, favoring linearly and hierarchically closer discourse content that can satisfy the presupposition [2], suggesting a **serial search retrieval** mechanism. However, presupposition triggers like *again* have been reported to be rapidly sensitive to presupposition violations [3], suggesting a **direct access retrieval** mechanism. These three possibilities may be distinguished by differences in the *availability* and *retrieval speed* of presupposed content. If presupposed content is not actively maintained, then it must be retrieved, in which case availability should be reduced as dependency length increases. If the retrieval process is not via direct access, the speed of this retrieval should be slowed as dependency length increases, indicating serial search [4].

We examined two types of presupposed content, Explicit vs. Inferred (i vs. ii), in a speeded acceptability judgement study (N = 34). Dependency length between *again* and this presupposed content was manipulated with Zero, One, or Two intervening clauses, and the presupposition of *again* was either Satisfied or Violated.

(i) Beth *went diving/*swimming* yesterday. $(\ldots)_1$ $(\ldots)_2$ Today, she *went diving* **again**.

(ii) Beth *got divorced/*fired* ten years ago. $(\ldots)_1$ $(\ldots)_2$ This year, she *got married* **again**.

In a *d'* analysis, participants were more accurate at resolving the presuppositional dependency with Explicit content compared to Inferred content (t=2.661, p<.010), but the critical factor of dependency length played no role, suggesting no *availability* differences. This lack of dependency length effect was confirmed in a diffusion analysis. No differences in *availability* (Explicit: p_α=.811; Inferred: p_α=.402) or *retrieval speed* (Explicit: p_τ=.092, p_δ=.777; Inferred: p_τ=.598, p_δ=.899) were found.

These results suggest that during the processing of anaphoric presupposition triggers, the presupposed content was available with no retrieval process required, suggesting an active maintenance theory of presupposition resolution. Only when the presupposed content must be inferred is there additional cost associated with resolving the dependency. A follow-up investigation involving the anaphoric trigger *too* is now underway.

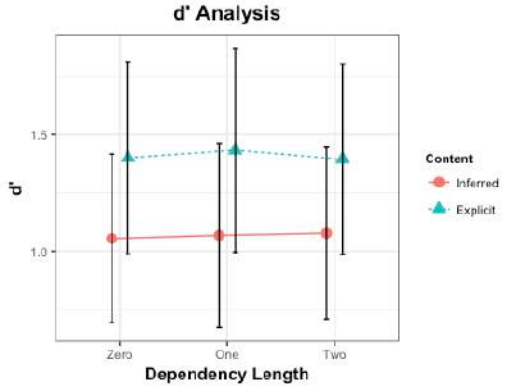


Figure: Model *d'* estimates of explicit vs. inferred content across dependency length.

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Development of the Russian case system in L2 adult Spanish-Catalan learners

Cherepovskaia Natalia[1], Slioussar Natalia[2,3], Denissenko Anna[1]
[1]Universitat Pompeu Fabra, Barcelona, Spain; [2]Higher School of Economics, Moscow, Russia; [3]Saint-Petersburg State University, Saint-Petersburg, Russia

This study investigates acquisition of the Russian case system and provides new insights on the acquisition of case in a morphologically rich language. We have studied the acquisition of the noun case paradigm by bilingual (Spanish-Catalan) adult learners. 196 written texts were elicited from participants with A1-C1 proficiency levels, aged 18-69.

Russian has six cases, three nominal declensions with several paradigms and various exceptions. Nouns may belong to one of the three genders (M, F, N) and are inflected for case and number. A single ending carries information about all these characteristics. The system includes diverse patterns of morphological syncretism. The case of the noun may be determined by a verb or a preposition this noun depends on, and/or by its semantic role. We propose that some of these factors play a greater role in the acquisition of the noun case paradigms than others.

The only study where L2 acquisition of the whole Russian case system is addressed is Rubinstein (1995). Rubinstein analysed case errors in the sentences elicited from American learners of Russian and concluded that over time the quality of case errors did not change but their quantity did. His approach relied on the core principles of the Error Analysis framework (Corder 1981), and the main criticism voiced against this framework seems to be relevant: when focusing on errors, one might miss the achievements, what an L2 learner does correctly at this or that stage.

To avoid this problem, we analysed both nouns with case errors (929 forms) and grammatically correct nouns (5980 forms). Our results show that the quantity of case errors gradually declines along with the change of their quality. At the same time, the number of correct case forms grows changing the distribution of nouns between different cases. The analysis of correct forms showed that at the advanced level the case system of Russian language learners shares some patterns with the system of native speakers (Slioussar & Samojlova 2015). At the beginner level, learners tend to overuse nominative and locative (prepositional) cases and to underuse dative, genitive and instrumental.

Beginners use nominative case on 69,9% of nouns, but their share gradually decreases until it is equal to 42,1 % at the advanced level. The share of locative (prepositional) forms decreases from from 17,7 % to 11,5%. In contrast, the proportion of other cases slowly increases: genitive from 1,8% to 13,8%; dative from 0,1% to 4,0%, accusative from 9,2% to 20,3%, instrumental from 1,2% to 8,4%. We can explain this by the morphological complexity of genitive forms and the order of presentation in class.

Forms with errors were distributed between the following four groups: primary form (learners use Nominative case instead of any other case), case mixing (usage of incorrect case), mixing of endings within one case, misused preposition. The distribution of errors between the groups changes with the level of learners: the vocabulary of the more advanced learners is richer in verbs and constructions that require different cases.

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Good Enough Processing of Garden-Path Sentences in Czech

Jan Chromý, Charles University (Prague)

The poster will deal with the assumption that sentence processing need not always be full and deep and that the resulting representation of the sentence may be rather shallow which is a central idea in the so-called Good-Enough Processing.

One of the researches under this approach is Christianson et al. (2001). Participants were showed garden-path sentences like *While Anna dressed the baby that was small and cute spit up on the bed* and they were asked questions like *Did Anna dress the baby?* In these cases, 65.6 % of participants answered the question incorrectly. In the control condition where the matrix clause was first and the subordinate clause second (i.e. *The baby that was small and cute spit up on the bed while Anna dressed*), only 12.5 % participants gave the wrong answer.

A similar experiment using garden-path sentences has been done in Czech. Participants (N = 86) read sentences like (1a) and (1b) using word-by-word self-paced reading.

(1a) Kluci	honili	psa	a	kočk-u	v	podkroví
Kid-NOM.M.PL	chase-3PL.M.PST	dog-ACC.M.SG	and	cat-ACC.F.SG	in	attic
znepokojovali	šediví	hlodavci.				
worry-3PL.M.PST	grey-NOM.M.PL	rodents-NOM.M.PL				

'Kids chased a dog and a cat in the attic was worried by grey rodents.'

(1b) Kluci	honili	psa	a	kočk-a	v	podkroví
Kid-NOM.M.PL	chase-3PL.M.PST	dog-ACC.M.SG	and	cat- NOM.F.SG	in	attic
znepokojovala	šedivé	hlodavce.				
worry-3SG.F.PST	grey-ACC.M.PL	rodents-ACC.M.PL				

'Kids chased a dog and a cat in the attic worried grey rodents.'

These sentences differed so that a garden-path effect was possible in (1a) (segment *kočku* could have been analyzed as an object of verb *honili* at first) but not in (1b) (segment *kočka* is a nominative and hence it cannot be an object in a transitive sentence in Czech). After reading each sentence, the participants were asked either a question like (2a) *Did the kids chase a cat?* or like (2b) *Did the rodent worry the cat?*: (2a) asked if the original garden-path interpretation was maintained and (2b) asked if the speakers formed a correct interpretation of the second main clause.

RTs for each segment and the correctness of the responses were measured. The linear mixed-effects analysis of RTs showed clear garden-path effects in sentences (1a) and not in sentences (1b) since RTs were significantly higher on segments *znepokojovali* and *šediví* than in the corresponding segments in (1b). Moreover, participants answered questions (2a) incorrectly in 33.9 % after reading sentences (1a) and only in 7.4 % after reading (1b). This was in accordance with Christianson et al. (2001). However, after reading sentences (1a), participants more often responded incorrectly (in 21.4 %) also questions (2b) than after reading sentences (1b) (only in 10.3 %).

The results indicate that the incorrect answers may not stem necessarily from the possibility of maintaining of the original garden-path representation. It could be so that readers sometimes do not form a coherent representation of the sentence at all and they just try to answer the question based on scarce information they actually retrieved.

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The variable and the constant in bilingual grammars: Evidence from Gradient Symbolic Computation

Clara Cohen[1,2], Lara Schwarz[2], Michael Putnam[2]

[1]University of Glasgow; [2]Center for Language Science, Penn State University

A fundamental challenge for models of language is the need to reconcile apparently discrete units—morphemes, clauses, phonemes—with utterances that combine these units in fundamentally gradient ways. Gradient Symbolic Computation (GSC) is a model of grammar whose architecture includes both discreteness and gradience. This paper evaluates GSC by applying its predictions to experimentally collected data containing patterns showing variations in word order produced by bilinguals in code-switched and monolingual utterances. As we show, this model's strikingly accurate predictions offer a promising architecture to explore more general patterns of variation in speech production, and offer insight into how different internal grammar structures can produce similar outputs.

The data used as a reference point were collected by Kootstra et al. (2010). In their experiments, Dutch-English bilinguals were asked to describe images by completing sentences with different provided preambles (e.g., *In this picture . . .*) . Key factors were (1) whether the participant was asked to switch between Dutch and English, and (2) the word order of the response. The structure of the prompt required one of three word orders in Dutch (SVO, SOV, VSO), but in English could only be SVO. We employed GSC to predict the distribution of utterances participants produced in the experiment.

Table 1: Summary of constraints

SPECLEFT (SL)	Keep specifier to left of clause
HEADLEFT (HL)	Keep head to left of clause
HEADRIGHT (HR)	Keep head to right of clause
MATCHPROMPT (MP)	Use the prompted word order
MAX	Do not omit constituents
MATCHSWITCH (MS)	Switch language when prompted

The GSC grammar we used included the constraints summarized in Table 1. Each must be weighted according to its influence in structuring utterances. In bilinguals, each language has its own set of constraint weights. We determined the weights for this grammar using a set of random walks through the parameter space. Final weights from these walks (Figure 1) were used applied to constraint violations for each possible response, and from these GSC predicted the probabilities of each utterance. These predictions closely matched the observed proportions of responses in the original experiment, with a correlation of at least 0.91 for all final weightings.

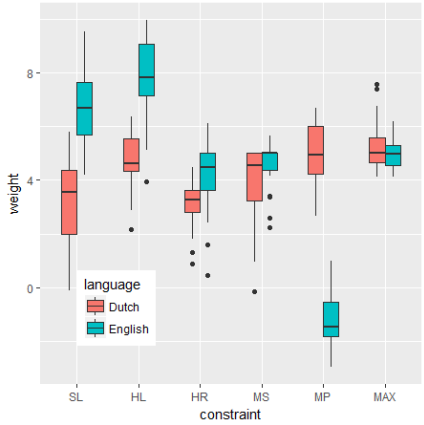


Fig. 1: Best-fitting constraint weights.

These weights offer insight into the nature of the bilinguals' two grammars. The word order constraints—SPECLEFT, HEADLEFT, HEADRIGHT—are all more highly weighted for English than Dutch, consistent with the more restrictive possible word order in English (SVO only) vs. Dutch. MATCHPROMPT's weight is much higher in Dutch than in English, indicating the participants followed the prompted word order more in Dutch than English. The wider variability in SL and HL compared to MAX shows that some constraints allow a more variety of weights than others while accurately predicting responses. Overall, these results provide both a reasonably accurate descriptive model of bilingual behaviour, and also insight into how bilingual grammars can vary across different individuals.

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Event structure and event duration in language comprehension

Marta Coll-Florit, Universitat Oberta de Catalunya (UOC), Barcelona, Spain
Silvia P. Gennari, University of York, UK

Previous results indicate that the internal causal structure of event concepts has processing consequences in reading: verbs referring to dynamic events, e.g., *build*, take longer to process compared to those referring to states, e.g., *love* [1]. This is consistent with the fact that events imply changes and are internally more complex than states. However, other results suggest that the typical duration of the event, rather than the causal structure, leads to more processing cost: when comparing short events to long states, e.g., *to fall into a pool* vs. *to own a pool*, stative phrases take longer to process than eventive ones, and processing times correlate with the duration attributed to the phrases' referents [2]. Event duration thus show a different pattern of results from causal structure.

To elucidate the contribution of event causal structure and duration to processing cost, we conducted two studies. First, we attempted to replicate the effect of causal structure in a different language and with different stimuli to confirm previous findings. Then, we combine long and short events and states within the same study.

Study 1 specifically compared the same Spanish verbs used in an eventive or stative interpretation as a function of the upcoming noun phrase in the sentence, i.e., the interpretation obtained once the object was understood, as in the Spanish versions of *The baker weighs one hundred kilos vs. The baker is weighing the sugar,* where both Spanish versions contain simple present tense. A completion pre-test confirmed that the stimulus verbs occur equally likely with either interpretation. The object noun lengths were also matched. In a reading study, participants read the words one at a time (self-paced reading). Whereas no difference was found at the verb position, at the object noun position (in Spanish: *cien kilos* vs. *el azúcar*), eventive interpretations took longer to process than stative ones ($t(25)=2.99$, $p=.002$). This confirms prior effects of event structure.

Study 2 exploited the *ser/estar* distinction in Spanish, two different '*be'* verbs that refer to permanent (long) or temporary (short) states respectively, and compared these states to long/short events, as in (1). These sentences were followed by the pronoun *Esto* 'this' referring back to the previous sentence, e.g. *This worries me*.

(1) States (short/long): *Juan está/es muy serio* 'John is (currently/typically) very serious'
Events (short/long): *Juan escribió una nota en su agenda/una tesis de psicología* 'John wrote a note in his diary/a thesis on psychology'

Reading times for the pronoun were analysed on the assumption that the meaning of the previous sentence is recovered when interpreting it. We found a main effect of duration ($F(1,63)=11.6$, $p=.001$)—long event/states took longer to read than short event/states—a main effect of event structure ($F(1,63)=74.3$, $p=.009$)—events took longer than states—and an interaction ($F(1,63)=8.9$, $p=.004$)—the difference between long and short events was larger than that for states.

Taken together, these results suggest that effects of event structure and duration modulate the processing cost of both events and states, but that duration influences each event-type differently. We will discuss possible conceptual representations that may give rise to these effects, such as semantic complexity and semantic diversity.

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Gender Attraction in Spanish Comprehension

Ian Cunnings (University of Reading), Jorge González Alonso (University of Tromsø), David Miller & Jason Rothman (University of Reading)

A key prediction of cue-based parsing is interference (Lewis et al. 2006). Agreement attraction, where ungrammatical sentences are perceived as grammatical ('the key to the cabinets were rusty'), is a well-studied example of interference during sentence processing (Lago et al. 2015; Wagers et al. 2009). Most existing research of attraction during comprehension has tested subject-verb number agreement, while other agreement phenomena, such as noun-adjective gender agreement, have been less well studied. To fill this gap, we investigated gender attraction during comprehension in Spanish, as in (1/2). In (1), the adjective (*castigada*) matches the gender of the head noun (*hija*), while (2) is ungrammatical as the head noun (*hijo*) mismatches the gender of the adjective. A distractor noun (*jardinero/a*) matches the gender of the adjective in (1a/2a) but not (1b/2b).

The only existing study on noun-adjective gender attraction in comprehension tested grammatical sentences only (Acuña-Fariña et al. 2014). They found longer reading times for sentences like (1b) compared to (1a), and interpreted this as indicating that the distractor's gender led to a faulty encoding of the head noun's gender. This is unexpected under cue-based parsing, which predicts retrieval interference from distractors that match, rather than mismatch, the adjective's gender. The clearest evidence for cue-based parsing would come from an attenuation of the ungrammaticality effect in (2a), when the distractor matches the adjective's gender, compared to (2b), but Acuña-Fariña et al. did not test such sentences. We examined attraction in sentences like (1/2) in two experiments (n = 32 in each). Experiment 1 was an acceptability judgement task. In Experiment 2 we monitored participants' eye-movements during reading to investigate the time-course of processing.

In Experiment 1, participants rated ungrammatical sentences as being significantly less acceptable than grammatical sentences ($p < .001$), while the distractor did not influence ratings. In Experiment 2, we found significantly longer reading times (ps < .001) at and after the adjective for ungrammatical sentences. In regression path times, there was a significant interaction ($p = .020$). Here, reading times were reliably shorter in (2a), when the distractor matched the adjective in gender, compared to (2b), when neither noun matched, while reading times did not differ in the two grammatical conditions.

These results suggest gender attraction influences early stages of processing, but does not persist to offline judgement measures. We did not replicate Acuña-Fariña et al. (2014), but did find evidence of attraction in ungrammatical sentences, similar to subject-verb agreement (Lago et al. 2015; Wagers et al. 2009). These findings indicate retrieval interference, rather than a faulty encoding of the features of the head noun, is the source of attraction during comprehension, as predicted by cue-based parsing (Lewis et al., 2006).

(1a) La hija de la jardinera estaba siempre castigada sin poder salir de casa.
(1b) La hija del jardinero estaba siempre castigada sin poder salir de casa.
(2a) El hijo de la jardinera estaba siempre castigada sin poder salir de casa.
(2b) El hijo del jardinero estaba siempre castigada sin poder salir de casa.

"The daughter(1)/son(2) of the gardener-FEM(1a,2a)/-MASC(1b,2b) was always grounded-FEM from leaving the house."

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The effects of speaker attributes and word properties on the latency and duration of spoken responses in word and picture naming

Rob Davies, Georgina Corkery, Becky Mullarkey, Jayne Summers (Lancaster)

Theories about cognitive word production processes explain the impact of word properties, like lexical frequency, on the latency (RT) or accuracy of responses in oral reading or speech production tasks (e.g. Seidenberg & McClelland, 1989; Levelt, Roelofs, & Meyer, 1999). Such theories are silent on the factors that influence response execution (durations, RDs). However, evidence from speech production corpora suggests that word durations are shorter for high frequency (e.g. Gahl & Strand, 2016; Moers, Meyer, & Janse, 2016) or high neighbourhood density words (Gahl & Strand, 2016). Cognitive reading or speech production theories focus on psycholinguistic effects on the average performance of young adults. However, recent work (Davies et al., 2017) shows that the effects on word pronunciation RTs, in reading, of lexical frequency and Age-of-Acquisition (AoA) decrease in size with increasing age and reading skill over the life-span. In the same study, pronunciation RDs were affected by age, reading skill, length, and lexical neighbourhood size, as well as by interactions between age and neighbourhood, and between phonological awareness skill and AoA effects. In contrast to the evidence from speech corpora, recent studies of single word production have indicated a limited influence on RDs due to lexical properties like frequency (Mousikou & Rastle, 2015). Given evidence for the importance of individual differences, we hypothesized it would be possible to detect psycholinguistic effects on pronunciation latencies and durations by taking into account variation in the effects due to their moderation by individual differences. We tested this prediction by observing speech production in oral reading and picture naming, for the same set of 100 words, in single word trials. We tested 140 children and adults (aged 9-69 years, M = 21 years). All participants did both tasks plus tests of reading skill, vocabulary, and phonological awareness.

Linear mixed-effects models indicated that reading RTs were significantly affected by participants' reading skill, vocabulary, by word frequency, and by interactions between age and length, age and frequency, and vocabulary and frequency effects. Picture naming RTs were affected by vocabulary, AoA, as well as by interactions between age and frequency, age and AoA, reading skill and AoA effects. Reading response RDs were affected by vocabulary, word length, and the interaction between vocabulary and length effects. Picture naming RDs were affected by vocabulary, length, interactions between reading skill and length, and by interactions between phonological awareness skill or vocabulary and frequency. Our observations reveal psycholinguistic effects on spoken word RTs and RDs, indicating that while theories do not extend beyond the explanation of latencies, they should.

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The role of information structure in children's comprehension of complex sentences – testing two hypotheses

Laura E. de Ruiter,[1]Elena Lieven[1], Silke Brandt[2], & Anna Theakston[1]
[1]LuCiD, University of Manchester, [2]LuCiD, Lancaster University

English allows two different clause-orders for complex sentences with adverbial clauses, e.g. (1) *She checked her emails before she went home*. vs. (2) *Before she went home she checked her emails.* Children have difficulty correctly interpreting isolated sentences like these up to the age of 6 or 7 (e.g., Blything, Davies, & Cain, 2015). However, in spoken discourse, sentences occur in context, and contain both new information and given information, which allows the listener to link it to the previous discourse (e.g., *Sue went home. Before she went home, she checked her emails)*. We identified two hypotheses about how information structure affects the processing of complex sentences:
1) Sentences are easier to process, if given information precedes new information (Haviland & Clark, 1974). 2) Sentences are easier to process, if the information presupposed in the subordinate clause is given (Gorrell, Crain, & Fodor, 1989).

We tested which of the two hypotheses better predicted 4- and 5-year-olds' (N=80) understanding of 4 different types of adverbial sentences (*after, before, because, if*), using a forced-choice picture story selection task. We systematically manipulated clause-order (main-subordinate, subordinate-main), and whether a context sentence provided information about the main or the subordinate clause (given main, given sub). We also took measures of working memory (WM), inhibition, vocabulary, and general language ability.

Our results support a combination of the two hypotheses: Children performed better when the initial clause was given, but only when this was the subordinate clause (Fig.1). We will present the complete data set, including effects of different sentence types, age, and individual differences in children's processing, and discuss the theoretical implications of the results.

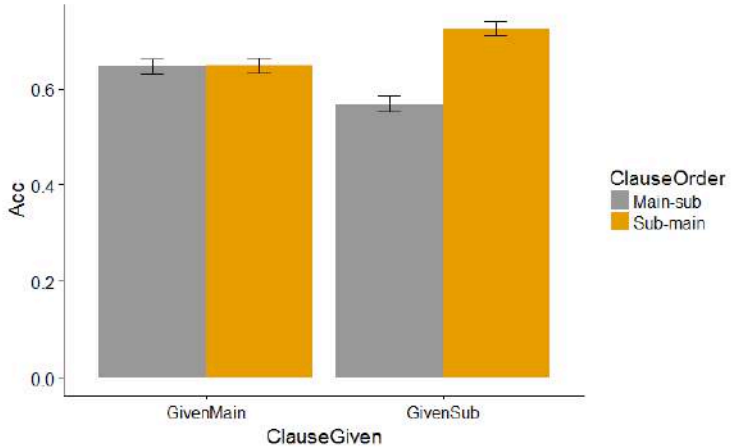


Figure 1: Mean proportion of correct responses. Error bars indicate standard errors.

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Bilingualism Effects on the L1 May Be Limited to Implicit Processes

Ricardo Augusto de Souza
Universidade Federal de Minas Gerais/CNPq (Brazil)
Cândido Samuel Fonseca de Oliveira
Centro Federal de Educação Tecnológica de Minas Gerais (Brazil)

The literature on bilingual language processing reports evidence that high L2 proficiency bilinguals exhibit processing behavior in their L1 that differs from monolingual speakers of that language. Specifically in the domain of sentence processing, examples of such bilingualism effects on the L1 are found, for example, in the comprehension and production of argument structure constructions (Fernández, Souza & Carando, 2017).

In the present study, we address an issue brought out by Souza, Soares-Silva & Silva (2016), reporting results from a study based on a timed grammaticality judgment task that fails to replicate bilingualism effects on the L1 in judgments of argument structure instances that emulate constructions that are part of the bilinguals' L2 repertoire only. Although the timed grammaticality judgment task has been argued to be a valid measure of implicit linguistic knowledge, recent psychometric studies challenge this assumption by showing that this task either does not tap into implicit knowledge, or does not tap into it as completely as online processing psycholinguistic tasks do (Vafaee et al., 2016). Therefore, we specifically probed the hypothesis that bilingualism effects on L1 detected by tasks tapping into implicit processes (online processing tasks) may not be detected by the timed grammaticality judgment task, which has been recently suggested to tap into explicit linguistic knowledge.

For the present study, we conducted two experiments with 26 participants who were high L2-proficiency bilinguals in Brazilian Portuguese and English, and whose performance was compared with a group 27 monolingual speakers of Brazilian Portuguese doing the same experimental tasks. One of the experiments employed the maze task (Foster et al., 2009), which yields an online measure of incremental sentence processing cost. The second experiment employed a timed grammaticality judgment task set within a time window of 6,000ms. The target items were sentences in Portuguese that emulated the linguistic behavior of the English resultative construction (e.g.: *Samuel hammered the nail flat*), which is unlicensed in Portuguese. Our results show a mismatch in the observations yielded by the two tasks. Only in the online processing task did the bilingual participants reveal L2 effects on L1 sentence processing, with significantly shorter RTs in the critical region of the target items ($t_1(39)=3.725$, $p<.001$; $t_2(14)=4.732$, $p<.001$). No bilingualism effect was evident in the timed grammaticality judgment task ($U=9751.5$, $W=16537.5$, $Z=-.262$, $p<.793$). We interpret our results by suggesting that the locus of cross-linguistic interactions in bilingual language processing may be mostly related to implicit processes.

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How are Questions Made? A Production Study of Object Wh-Questions

Monica Do, Elsi Kaiser, Pengchen Zhao
University of Southern California

Introduction: Production is incremental: Only some parts of sentences are planned before speaking while the rest is planned 'on-the-fly' (Bock & Levelt 1994). One question is how linguistic factors – e.g. linear word order versus subjecthood – influence how speakers *start* formulating their messages during early moments of utterance planning. According to linear accounts, speakers start with a lexical item that ultimately becomes the subject of a sentence (Brown-Schmidt & Konopka 2008); by contrast, *structural* accounts posit that speakers start with a structural frame that guides lexical selection (Griffin & Bock 2000). In English, because subjects are often both the linearly and structurally first element of a sentence, these two accounts can be hard to disentangle. Thus, some work has investigated planning in languages where the subject is not linearly first (Myachykov 2011; Norcliffe et al 2015). But, whether message formulation strategies in these languages are language-general or language-specific remains unclear.

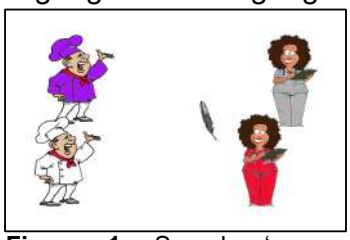


Figure 1: Sample 'nurse-tickle-chef' image

Experiment: We de-couple effects of linearity from subjecthood by comparing production of English declaratives (subject-initial: 'The nurse tickled the chef') and object wh-questions (object-initial: 'Which chef did the nurse tickle?'). In a visual-world eye-tracking task, 30 English speakers described or asked object wh-questions about transitive scenes. (We also incorporated auditory distractor words, not relevant to claims here.) **Predictions:** If message formulation is linearly-driven, then right after the image appears, speakers should show early looks to subjects in declaratives (**S**VO) but to objects in questions (**O**SV). But, if message formulation is subjecthood-driven, speakers should look to subjects first in *both* declaratives and object wh-questions.

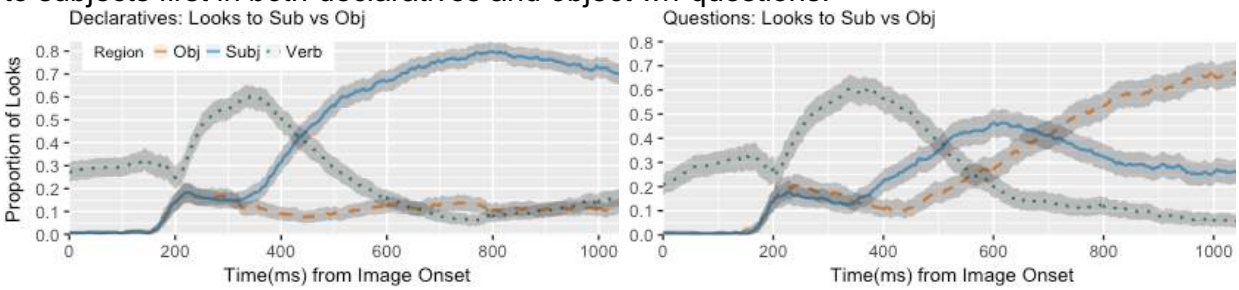


Figure 2: Proportion of looks to the object, subject, and verb after image onset. Shaded regions show 95% CIs. By design, speakers initially fixate the verb to determine which character is the subject/object.

Results: 400-600ms after image onset, there are more subject-fixations than object-fixations in declaratives and question, consistent with the structural hypothesis. However, by 600ms declaratives (subjecthood and linearity converge) show an overwhelming subject preference (ß=1.42, SE=.71, |z|=2.02), while object looks remain low. But, in questions (linearity and subjecthood are pitted against each other), looks to the subject and object rise simultaneously and do not begin to diverge until after 600ms (ß=-1.71, SE=.61, |z|=2.78), suggesting that the subject preference is not as clear-cut. **Conclusion:** We present novel eye-tracking data on the production of wh-questions. We find that even if there is a privileged role for subjecthood, the time course of fixations in declaratives versus questions differs, suggesting that linearity and subjecthood are a) ***separable***, b) emerge ***simultaneously*** and c) ***modulated by the structure*** at hand. We corroborate prior work (Kuchinsky et al 2011) pointing towards a dynamic model of message formulation where multiple factors compete.

Modeling lexical access in ACT-R

Jakub Dotlačil and Adrian Brasoveanu

One very robust parameter affecting latencies and accuracies in lexical decision tasks is frequency. In their detailed study on its role, Murray and Forster (2004) (M&F) collected responses and response times in a lexical decision task using words from 16 frequency bands (their Exp. 1) and argued that their findings support a specific retrieval mechanism, the Rank Hypothesis. They note that frequency effects could also be modeled as skill learning (Anderson 1982 a.o.). Skill learning is implemented in the ACT-R cognitive architecture, so it is a natural testing ground for the lexical decision task and the rich data set in M&F. This detailed ACT-R modeling of lexical decision has not been done and it is the contribution of this paper. In addition, we use general-purpose Bayesian modeling libraries to model the ACT-R account of lexical decision data: the `python3` libraries `pymc3` and `theano`. This enables us to provide a general way of estimating crucial ACT-R parameters that are usually set by hand.

In ACT-R, the base activation of a lexical item is a power-function of the time since n-many practice trials / 'rehearsals' of a word – (1). The activation is used to compute accuracy and latency for retrieval – (2) and (3). The free parameters are enumerated in parentheses.

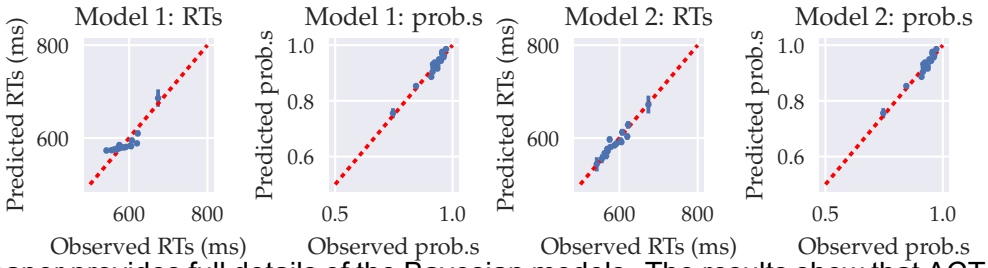
(1) $B_i = \log\left(\sum_{k=1}^{n} t_k^{-d}\right)$ (d: decay)

(2) $P_i = \frac{1}{1+e^{-\frac{A_i-\tau}{s}}}$ (s: noise, τ: threshold)

(3) $T_i = Fe^{-fA_i}$ (F:factor, f: exponent)

For any word, the number of rehearsals that contribute to its base activation was determined by its frequency and the number of words per year average humans are exposed to (estimated using Hart and Risley 1995). Two models were built for the M&F data, the crucial difference between them being whether the latency exponent f was ignored, i.e., set to its default value of 1 as it is in most ACT-R models (Model 1), or was estimated (Model 2). Both models also had a latency intercept, meant to capture the latency of the operations other than actual memory retrieval necessary to complete the task, e.g., motor operations.

Model 1 fitted retrieval accuracy well, but latencies were poorly modeled – see the two leftmost panels. In contrast, Model 2 had a good fit for both accuracy and latency – the two rightmost panels. The plots show posterior estimates (on the y axis) against the observed values (on the x axis). The blue points are the observed data against predictions; the blue segments provide 95% credible intervals (CRIs) for the predictions; the diagonal (red) line plots the subspace where observations and predictions are identical.



The paper provides full details of the Bayesian models. The results show that ACT-R can be used to model the role of frequency in lexical decision tasks very well. The fact that Model 1 fails in modeling latencies, unlike Model 2, makes an important point for previous psycholinguistic ACT-R work (Lewis and Vasishth 2005 a.o.): the latency exponent f is essential but to the best of our knowledge, all psycholinguistic ACT-R models approximate retrieval latencies by manipulating only the F parameter. Our results cast doubt on the received way of modeling retrieval in ACT-R psycholinguistic models, or at the very least show that different parameters might modulate different cases of retrieval in language processing.

Individual Differences in the Production of Disfluency

Paul E. Engelhardt (University of East Anglia) and Martin Corley (University of Edinburgh)

Recent work has begun to focus on the role that individual differences in executive function and IQ have on the production of fluent speech (e.g. 1). However, isolating underlying causes of different types of disfluency has been difficult given the speed and complexity of language production (cf. 2,3). In related research, studies have examined individuals with high-functioning forms of ASDs (HFA) to address a theoretical question regarding speaker- and listener-oriented disfluency (e.g. 4). Speaker-oriented disfluencies are produced to be helpful (or cooperative), and listener-oriented disfluencies are due to a range of speaker-internal factors related to difficulties in language production (e.g. word retrieval failures). Individuals with HFA are ego-centric and have poor pragmatic language skills, and should be less likely to produce listener-oriented types of disfluency. However, previous (HFA) studies did not account for individual differences variables that affect disfluency. In order to investigate the role of executive functioning and IQ in disfluency production, we conducted two experiments. The first examined individual differences in a large sample of typically-developing participants, and the second examined a sample of individuals diagnosed with HFA. In both, we utilized a sentence production task in which participants memorized and repeated 40 syntactically complex sentences (5).

In E1, we focused on the role of working memory and verbal IQ, as previous work highlighted verbal IQ as an important factor in disfluency production (e.g. 1). However, we hypothesized that a substantial proportion of disfluencies would be due to memory retrieval failures. Model comparisons were carried out using hierarchical SEM. Results showed that repetitions were significantly related to verbal IQ. Unfilled pauses and repairs, in contrast, were marginally ($p < .09$) related to memory abilities. Conclusions for E1 explore the link between disfluency and problems arising in production, and how individual differences inform theories of **sentence** production. A topic which is noticeably absent in existing literature.

In E2, we re-evaluated conclusions about disfluency production in HFA. Previous studies examined individuals with HFA to determine speaker- and listener-oriented disfluency. However, that research did not account for factors affecting disfluency production (e.g. verbal IQ). In E2, we show that (age and gender) matched and unmatched controls produce fewer repairs than individuals with HFA. For unfilled pauses, there was no difference between matched controls and HFA, but both groups produced more than unmatched controls. Conclusions for E2 identify limitations in prior research and shed light on the relationship between autism spectrum disorders and disfluent speech.

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Telicity cross-linguistically: an eye-tracking study

Francesca Foppolo[a], Miguel Santin[b], Julia Danu[b] and Angeliek van Hout[b]

[a]University of Milano-Bicocca, [b]University of Gröningen

Accomplishment predicates (like 'peel an apple') describe events that have a duration and a culminating point (Vendler, 1967). When combined with perfective aspect they have a completion entailment that the telos has been reached (the apple is completely peeled). Using behavioural and reading methods, previous studies show that participants do not immediately commit to the telicity of event descriptions (Pickering et al. 2006). Our study employs the visual world eye-tracking paradigm as a more sensitive method to capture the culmination inference, using the same paradigm as Foppolo et al. (2016). They recorded participants' eye-movements during the processing of Italian sentences like (1)-Table 1 in a context with two pictures, one showing a completely colored star (target) and the other showing a coloring event in progress (competitor). This critical condition (Perfective) was contrasted with Early and Late control conditions in which disambiguation towards the target happened early (at the verb) or late (at the noun). We extended this method to a cross-linguistic investigation of Dutch (N=23), Russian (N=25) and Spanish (N=24), which differ as to how perfectivity is realized (Table 1), to test how different ways of marking the perfective affect the incremental processing of telicity. Results are given in Figure 1 and Table 2. In line with Foppolo et al., we show that perfective morphology is exploited during incremental processing to trigger the inference of completion in the three languages, as shown by the significant advantage of the critical condition w.r.t. Late controls in Dutch and Russian, prior full disambiguation (in Spanish, the effect is slightly delayed). Nonetheless, the significant advantage of the Early condition w.r.t. Perfective show that auxiliary alone does not suffice to trigger this inference (in Dutch and Spanish) and neither does the perfective prefix in Russian.

Table 1. Cross-linguistic variation in aspectual marking for 'Tell me where Sara has colored the star'

Language	Perfective sentence (PF)	Type of AUX	PERFECTIVE marker
Italian	(1) ha colorato la stella	Ambiguous (Aux or main V)	suffix on participle
Dutch	(2) heeft de ster gekleurd	Ambiguous (Aux or main V)	prefix on participle
Russian	(3) zakrasila zvezdu	NO aux	prefix on main verb
Spanish	(4) ha coloreado la estrella	Unambiguous	suffix on participle



Figure 1. Time course of fixations to completed (target) vs. incomplete action (competitor) in Dutch, Russian, Spanish (from left) across conditions: Perfective=blue; Early = Red; Late = Green.

Table 2. Pairwise comparisons across conditions and languages in the first 400ms time-window after disambiguation (i.e. object in Russian and Spanish; verb in Dutch)

	Dutch			Russian			Spanish		
	t	df	p	t	df	p	t	df	p
Perfective – Late Control	2,574	22	.017	-3,090	24	.005	,822	23	.419
Late Control – Early Control	-6,638	22	.000	6,680	24	.000	4,574	23	.000
Perfective – Early Control	-5,318	22	.000	3,099	24	.005	-4,193	23	.000

The Influence of Temporal Context on the Production of Temporal Morphology In L2 speakers of English

<*Qingyuan Gardner, Holly Branigan & Vicky Chondrogianni, University of Edinburgh*>

Adult second language (L2) speakers frequently make inflectional errors in production (Lardiere, 1998), especially when their L1 does not use inflectional marking. Different accounts of optional inflectional marking explain these errors in different ways, including absence of the appropriate grammatical representations (Hawkins & Chan, 1997), or problems in production processes alongside intact representations (e.g. Prevost & White, 2000). At the same time, accuracy in production can be modulated by featural complexity. Chondrogianni & Marinis (2012) argued a featurally more complex temporal inflection (3rd person singular present *–s* marking both tense and number) would be more difficult to produce than a simpler inflection (past tense *–ed* marking only tense).

The present study addresses these issues by examining whether temporal context affects morphological accuracy in L2-English production by L1-Mandarin speakers (whose L1 does not overtly mark tense). If L2 speakers consistently use tense-appropriate inflections under different temporal contexts, it would indicate that they have the appropriate grammatical representations, in support of a processing account. A higher error rate for complex (*-s*) than simple *(-ed*) inflections would further support this account.

17 Advanced L2 and 17 native English speakers produced scene descriptions for transitive events. We manipulated both temporal context (Past, Present Habitual) and subject number (singular, plural), to elicit obligatory temporal morphology (past tense *–ed*, 3rd person singular *–s*). Participant descriptions were coded for inflectional type and accuracy. A logistic regression analysis on the L2 group showed that Mandarin speakers produced temporal-context-appropriate morphemes: temporal context was a significant predictor for both past tense *-ed* and 3rd person singular *-s* endings (p<.001) in this group. Morphological accuracy was significantly lower in the Present Habitual context (requiring a more complex inflection for 3rd person singular; M=41.0%) than the Past temporal context (requiring a simpler inflection for both singular and plural subjects; M=46.3%; p<.001). The L2 group made persistent errors in omitting or producing incorrect inflections, especially in the Present Habitual context, *e.g. Every day the woman end the class at 3.15*.

The results demonstrate that L2-English speakers whose L1 does not overtly mark tense are sensitive to temporal cues when producing inflectional morphology, but these temporal cues are used inconsistently which result in high inflectional error in production. These results argue against an account in which these speakers do not have a representation for tense (which would wrongly predict absolute omission), and are consistent with an account that emphasizes processing difficulties associated with production of morphological inflections. Moreover, the high number of 3rd person singular *-s* omissions suggests that these processes are highly influenced by featural complexity.

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The How and the Who of Repeated Reference in Text

Alan Garnham and Bojana Ivic, School of Psychology, University of Sussex, UK

Coherent text contains repeated references to the same people and objects. Second and later references often use different referring expressions, usually shorter, and with less content (e.g. a pronoun following a proper name). According to Fukumura and van Gompel (2010) the form of the second reference is determined by grammatical properties of the first reference (e.g., subject vs. object) but not by local semantic factors, such as thematic roles and implicit causality (e.g., Stimulus vs. Experiencer), which influence only who is referred to (e.g., stimulus is preferred to experiencer in a causal continuation). By contrast, Arnold (2001) suggested that form of reference is affected by both grammatical and local semantic factors, thematic roles in particular (e.g. Goals are more likely to be pronominalized than Sources).

Using a pencil and paper sentence completion paradigm, based on the method of Fukumura and van Gompel (2010), eight experiments investigated the role of grammatical and local semantic information in determining who is referred to and how. The experiments used both mental state verbs (SE and ES in the implicit causality literature, e.g. “scared”, “feared”), as used by Fukumura and van Gompel, and verbs of transfer (GS and SG – goal-source and source-goal, e.g., “bought”, “gave”), used by Arnold. Following Fukumura and van Gompel, in some studies we used arrows to indicate which person in the first clause should be referred to in the continuation. These experiments were designed to investigate how reference was made (repeated name vs. pronoun). Experiments with no arrows present were used to investigate which person was referred to. We also varied whether the suggested continuation was causal (“This was because…..”), consequential (“and so”), or open ended (no connective).

Throughout the series of experiments, there were clear effects of the grammatical role of the antecedent on the likelihood of pronominalisation (more likely for subject than object antecedents). In the most constraining conditions (arrow to indicate reference and “This was because”/”and so” to indicate the type of continuation), there was no statistical evidence for a semantic effect on pronominalisation, though, numerically, goals (vs. sources) and experiencers (vs. stimuli) were followed by a higher proportion of pronouns. In the less constrained conditions, parallel effects were significant.

In addition, where the type of continuation was unconstrained, mental state verbs were followed primarily by causal continuations, in line with the findings of Kehler et al. (2008). Consequences were the most common continuation for verbs of transfer, in line with Arnold’s findings, though causes and elaborations were also relatively common.

Preference for who was referred to switched between causes and consequences for mental state verbs, but not verbs of transfer, as predicted by Crinean and Garnham (2006).

Our results provide a broader and more nuanced picture of the factors determining who is referred to in texts, and what referring expressions are used to refer to them.

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Re-modeling incremental and holistic processing in multi-word comprehension

Aleksander Główka, Stanford University

Sentence comprehension is inherently incremental, as sentences unfold in real time and do not become available in their entirety until some time has elapsed. A prevailing assumption in sentence comprehension models is that (multi-)word representations compatible with accruing evidence are activated or computed, predictively constraining the selection of the target sentence (e.g. Levy 2008). I term this 'the incremental account'. Other research has shown that comprehenders are sensitive to the frequency of whole sentences independently of that of their parts, indicating that information about sentence wholes is not dynamically weighted against information about their parts (Arnon & Snider 2010). I term this 'the holistic account'.

Here we ask whether the incremental and holistic account can *non-redundantly* coexist in a single model by conjunctively modeling measures informing these accounts with data from studies using different tasks involving four-word sequence comprehension (Arnon & Snider 2010 (AS); Tremblay & Tucker 2011 (TT)). Our goal is compounded by the fact that, while the holistic account is based on frequency alone, the incremental literature includes several related measures estimated from N-gram language models, and it is unclear which are the most appropriate. To address this intermediate issue, we propose an integrative characterization of incremental processing as a two-dimensional space defined by syntagmatic and paradigmatic axes, incorporating mutual information and conditional probability. On the syntagmatic axis, the target is evaluated against its sub-representations (ABCD vs. A, AB, ABC). On the paradigmatic axis, it is evaluated against partially overlapping representations (ABCD vs. ABCE, ABCF, etc.).

We combined mixed-effects regression, multimodel inference (Burnham & Anderson 2002), and bootstrap aggregation (Efron & Tibshirani 1993) to build generalizable, hypothesis-driven conjunctive models of multi-word measures. We assigned the measures into models embodying alternative psycholinguistic accounts: holistic (frequency), incremental (incremental measures), and dual stream (including both). After reducing collinearity, we fitted regressions to the bootstrapped data for each model. Bagged AIC values showed that the dual stream model (AS: $\bar{x}$ =81.6, 95% C.I. = ±1.8; TT: $\bar{x}$ = −4601.5, 95% C.I.= ±23.8) approximates the true process better than its holistic (AS: $\bar{x}$=87.5, 95% C.I.= ±1.8; TT: $\bar{x}$ = −4585.2, 95% C.I. = ±23.6) or incremental (AS: $\bar{x}$ = 93.4, 95% C.I. = ±1.8; TT: $\bar{x}$ = −4570.4, 95% C.I. = ±23.7) counterparts. This indicates multi-word comprehension non-redundantly integrates offline holistic exemplars and incrementally weighted hypotheses. We discuss possible psycholinguistic motivations for dual stream processing and evaluate existing proposals compatible with this account.

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Acquisition of noun case marking in morphologically complex languages

Sonia Granlund[1,2], Joanna Kołak[1], Virve Vihman[3], Felix Engelmann[1], Ben Ambridge[2], Julian Pine[2], Anna Theakston[1], Elena Lieven[1]

[1] University of Manchester, [2] University of Liverpool, [3] University of Tartu

The current study elicits children's production of nominal case marking in three morphologically complex languages – Estonian, Finnish and Polish – which differ in the nature and complexity of the system, involving both suffixes and stem changes. Research on English morphological learning has shown that both token frequency and phonological neighbourhood density impact on rates of learning (e.g., Matthews & Theakston, 2006). However, few studies have examined whether input-based accounts can explain children's acquisition of morphology cross-linguistically, especially in languages with dissimilar morphological systems.

Altogether, 132 children between the ages of 32 and 63 months participated in the study. Children were shown drawings of a character interacting with various noun objects in five to six contexts requiring different case-marked forms. The experimenter named the object in its nominative form, and produced a lead-in sentence designed to elicit each case (e.g., "This is a ball. The fox is waving at…"), prompting the child to provide the final word, a case-marked noun. Three nouns from a range of form frequencies were chosen from 8 (Estonian), 9 (Finnish) and 10 (Polish) declension classes. These classes varied in phonological neighbourhood density (PND), which were based on CDS corpora. This resulted in 24 to 30 tested nouns in total. Each child was exposed to half of the tested cases for each noun. We expected to find that greater accuracy is predicted by greater frequency of the form and higher PND in the input.

Overall error rates were low (12-18%). Analysis of errors with mixed-effects models revealed that, in Polish, children made more errors with noun forms with lower token frequencies in the input (β=0.21, SE=0.05, $\chi^2(1)$=13.86, p=0.0002). No token frequency effect emerged in Estonian and Finnish but in those two languages, children made more errors on nouns belonging to noun classes with fewer phonological neighbours (Estonian: β=0.79, SE=0.23, $\chi^2(1)$=9.10, p=0.003; Finnish: β=0.34, SE=0.23, $\chi^2(1)$=4.38, p=0.04). In Estonian and Polish, we found an interaction of token frequency and PND (Estonian: β=-0.17, SE=0.06, $\chi^2(1)$=7.03, p=0.008; Polish: β=-0.10, SE=0.05, $\chi^2(1)$=3.90, p=0.048) which implies that the group PND effect was greater for lower than for higher frequency tokens. In all languages, accuracy improved with age.

Overall, the results suggest that token frequency and PND predict children's knowledge of case marking cross-linguistically, but are possibly mediated by the typological features of each language. We will discuss the various ways these typological differences may explain the results in our study.

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Homophones and their representations in the mental lexicon

Frauke Hellwig & Peter Indefrey
Heinrich Heine University Düsseldorf

Jescheniak, Meyer & Levelt (2003) observed that low frequent (LF) homophones are named faster than frequency-matched non-homophonous words in a translation task. They interpreted this finding as being due to shared lexical word form representations enabling the low frequency (LF) homophone to 'inherit' the higher frequency of its twin. Gahl (2008), on the other hand, found a systematic difference in pronunciation length between LF and HF heterographic homophonic word forms when analysing a corpus of American English natural speech, with HF homophones being pronounced faster than their LF twins. She argues that this finding is best compatible with non-shared lexical representations of homophones including fine phonetic detail.

To shed some more light on this debate we tried to replicate Gahl's findings experimentally, embedding the German stimuli of Jescheniak et al. (2003) in sentences (1).

1. Ich glaube das Haus ist **alt** und baufällig und man sollte es einfach abreißen.
   *(I think the house is **old** and decrepit and one should simply demolish it.)*
   Ich glaube sie singt im **Alt** und nicht im Sopran, weil sie das weniger anstrengend findet.
   (*I think she sings **alto** not soprano, because she finds that less exhausting.*)

As the members of their homophone pairs differed in syntactic category and hence required different syntactic environments potentially affecting the length of the pronounced words, we added 10 heterographic and 34 homographic homophone pairs as controls. Their frequencies were estimated on the basis of corpora of the *Berliner Zeitung* (www.dwds.de) and of SUBTLEX-DE (Brysbaert et al., 2011). These homophones were all nouns and embedded in sentences that were identical up to the homophone (2).

2. Jan sagte, dass eine **Saite** der Gitarre gerissen sei. *(Jan said that a **string** of the guitar had snapped.)*
   Jan sagte, dass eine **Seite** der Zeitung zerrissen sei. (*Jan said that a **page** of the newspaper was torn.*)

Participants read the sentences first silently then aloud ('reading'). The sentences then disappeared from the screen and participants repeated them from memory ('retelling'). Data analysis is still on its way, but in preliminary analyses the HF homophones of Jescheniak et al. (2003) were spoken about 50 ms faster than their LF twins in both reading and retelling. It is unlikely that this length difference is due to their different syntactic environments, because we found a similar length difference (40-50 ms) for the better-controlled heterographic noun homophones. Length differences between HF and LF homographic noun homophones seem to be much smaller (5-10ms). Overall, and also for homographic noun homophones alone, word length differences showed medium-sized correlations (r = 0.4 to 0.5) with log lemma frequency differences between HF and LF homophones. Our results so far suggest that the frequency-dependent length effect reported in the corpus-based study of Gahl (2008) can be replicated with experimental sentences. As this effect is also found for homophones showing frequency inheritance, it might not arise at the level of lexical word forms but at a later processing stage.

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Yes they can: subject binding of German demonstrative pronouns

Stefan Hinterwimmer & Andreas Brocher (University of Cologne)

German demonstrative pronouns of the *der*/*die*/*das*-paradigm (DPros) are known to avoid prominent discourse referents as binders. Prominence has been defined in terms of subjecthood, topicality, and agentivity (e.g., Hinterwimmer, 2015; Schumacher et al., 2016). Recently, Hinterwimmer and Bosch (2016) argued that individuals functioning as *perspectival centers* are also prominent and therefore avoided by DPros. An individual *x* is the perspectival center with respect to a proposition *p* if *p* expresses the content of an utterance or thought of *x*. This assumption accounts for the observation that DPros can typically not be bound by subjects of propositional attitude verbs (Wiltschko, 1997). However, one exception to that observation might be cases in which the subject of a propositional attitude verb (e.g., *to think* in (1)) is contained in a complement clause, provided that there is a more prominent perspectival center available. In a sentence, then, in which the propositional attitude verb is itself contained in the complement clause of a higher propositional attitude verb (e.g., *to claim*), the subject of the higher propositional attitude verb (*Lisa* in (1)) should be a more prominent perspectival center than the subject of the lower propositional attitude verb (*Klaus*). This, in turn, should allow binding by the lower but not the higher subject. We conducted two sentence reading eye-tracking experiments to test this hypothesis.

(1) Lisa behauptet, dass Klaus denkt, dass dessen Ferrari eine gute Investition war.
Lisa claims that Klaus thinks that his$_{DPro}$ Ferrari was a good investment.

In Expt1, 23 participants read 16 critical sentences (and 56 filler sentences), which contained the masculine marked DPro *dessen/ his*$_{\text{DPro}}$. In the *matrix center* condition, the higher, matrix subject was male, allowing binding by the DPro, and the lower, embedded subject female, disallowing binding by the DPro. In the *embedded center* condition, the matrix subject was female (no binding) and the embedded subject male (binding). Regions of interest were the noun phrase headed by the DPro (*dessen*/*his*$_{\text{DPro}}$) and including a noun (*Ferrari* in (1)). The immediately following word was the spillover. Sentences were identical across conditions, except for the order of the male and female subject. Analysis of log-transformed reading times showed that, compared to the *embedded center* condition, the *matrix center* condition yielded a reading slow-down (gaze durations, $t(22) = 2.14$ $p = .041$; total times, $t(22) = 3.14$, $p = .005$), including the spillover region (gaze durations: $t(22) = 2.03$, $p = .055$; total times: $t(22) = 1.91$, $p = .069$).

To ensure that the observed contrasts in Expt1 were not due to recency (the male embedded subject was closer to the DPro in the *embedded center* condition than the male matrix subject in the *matrix center* condition), in Expt2 with 24 participants, we used the materials of Expt1 but varied the pronoun heading the critical noun phrase. Crucially, the potential (i.e. male) binder was always the matrix subject. The embedded subject was always female. In the *DPro* condition, the pronoun was a DPro. In the *PPro* condition, it was a personal pronoun (*seinen*/*his*$_{\text{PPro}}$), which should not incur any reading slow-down. Other than pronoun type, sentences were identical between conditions. We observed a reading slow-down for DPro compared to PPro sentence versions (gaze durations, $t(23) = 3.20$, $p = .004$; total times, $t(23) = 4.93$, $p < .001$), with no spillover effects. This argues against a recency explanation for the data of Expt1.

Training stress awareness in a mobile serious game for dyslexic children

Heiko Holz[1], Katharina Brandelik[2], Detmar Meurers[1,3]

1 LEAD Graduate School & Research Network, University of Tuebingen
2 TIL GmbH – Tübinger Institut für Lerntherapie
3 Theoretical Computational Linguistics, University of Tuebingen

Shortcoming in the perception of prosodic features is a strong predictor for developmental dyslexia (Goswami et al., 2013; Leong, Hämäläinen, Soltész, & Goswami, 2011; Sauter, Heller, & Landerl, 2012). One of these features is syllable stress, an important characteristic of German speech rhythm. Performance in detecting stress highly correlates with reading and writing skills (Brandelik, 2014; Sauter et al., 2012). One explanation is thought to be found in the association between stress and German orthographic markers – vowel length markers generally occur in stressed syllables.

Therefore, processing verbal stress adequately might help children to acquire the complex spelling rules that underlie vowel length spelling in German orthography. However, to the best of our knowledge, there are no German (mobile) serious games that focus on improving the awareness of syllable stress or associate the stressed syllable's linguistic features to orthographic principles of the German orthography.

The aim of this research is to fill this gap. We present a therapy approach for German dyslexic children aged 5–12 in form of a mobile serious game. The game aims first at improving the awareness of the stressed syllable's linguistic features. In a second step, children acquire metalinguistic knowledge about the association between these features and German orthographic rules.

In total, four mini-games have been developed that cover the domains of stress pattern recognition, recognition of open and closed syllables, metalinguistic knowledge about orthographic markers, and spelling exercises. These mini-games are combined into a single mobile game called "Prosodiya" which is settled in a fantasy themed world. Little inhabitants called "Kugellichter" ("spherical lights"), kindred to will-o-wisps, guide the children through the world of syllables and orthography and teach them that in order to obtain the might and wisdom of words, they have to understand and use the "power of the stressed syllable".

To evaluate the effects of this therapy approach, a randomized control trial with a waiting control group design is planned for the summer term of 2018.

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Case study on the reliability of growth curve analysis

Yujing Huang, Harvard University
Jesse Snedeker, Harvard Universtiy

Language processing data collected with Visual World Paradigm (VWP) are usually analyzed with generalized linear model (GLM) by averaging the fixation proportion in a single time window. It has been argued that this averaging results in the lost of the fine-grained time course information. Therefore, Mirman et al (2008) proposed to use growth curve analysis (GCA) for VWP data. While GCA is applied to more and more VWP language processing studies (e.g., Brown et al, 2011; Kukona et al 2011; Koring et al, 2012), in this paper, we use a case study to show that this model does not always give reliable results and we need to be cautious about the application of the model.

We conducted two replications of Koring et al (2012) (n=40, n=60). The study consisted of 40 trials. In each trial, participants saw four black-and-white drawings while listening to an audio stimulus. Their eye-movements were recorded and coded based on whether they were looking at the target drawing at each sampling point. Following Koring et al (2012), we analyzed the data with experimental conditions and time polynomial factors as predictors using GCA. It is found that not only the results are different from those of Koring et al (2012), the results in the two replications are different while the two studies have exactly the same stimuli (see Table 1).

Table 1

Window	Term	Koring et al. (2012)	Experiment 1	Experiment 2
Verb	linear*condition	n.s.	p<0.005	p<0.005
	quadratic*condition	p<0.001	n.s.	p<0.001
Post-verb	linear*condition	p<0.005	n.s.	n.s.
	quadratic*condition	p<0.001	n.s.	n.s.
	cubic*condition	n.s.	n.s.	n.s.
	quartic*condition	p<0.0001	p<0.005	n.s.

The above results raised concerns about the reliability of GCA models. Therefore, we tested the model with resampling technique. In each resampling, we randomly assigned a condition label to each item to create a sample that is consistent with the null hypothesis. We repeated this procedure 1000 times to create an empirical distribution. We performed the GCA model used in the above experimental data on each sample. It was found that each term in Table 1 comes out as significant 20-70% of the time when the threshold is set to 0.05 (i.e. in theory, only 5% of the outcome should be significant). The result suggests that with this specific case study, GCA turned out to be very anticonservative. We discuss the possible reasons for this outcome.

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Speech errors in the L1, triggered by code switches from the L2

Clara Huttenlauch, Tina Bögel, Bettina Braun
Department of Linguistics, University of Konstanz, Germany

Models of bilingual speech production assume that L1 and L2 sounds share the same phonological space (Best, 1995; Flege, 1995), leading to bidirectional interference in phonetic realization (e.g., Antoniou, et al., 2011). Little is known about whether L2 sounds in code switches affect the realization of L1 sounds in otherwise L1 sentences. A recent production study on German showed that German speakers occasionally replaced German [ʁ]-sounds by rhotic English [ɹ] in verbs that preceded or followed English names (Schlipf, 2017). In the present study we investigated the mechanisms and limits of such r-intrusions from L2 code switches in more detail. First, we tested whether the effects generalize to non-initial position (e.g., *ge**r**aucht* 'smoked'). Second, we increased the trigger types by using English names starting with [ɹ], English names with another non-native sound ([w]), English names with consonants that also occur in German ([s,t,n,l,k,g]), as well as German names starting with [ʁ] as controls. This allows us to decide whether r-intrusions are caused by (1) the activation of L2 English in general (more intrusions from English names), (2) by all non-native sounds (more intrusions from English [ɹ] and [w]-names) or (3) by orthographic proximity (more intrusions from English [ɹ]-names only).

We selected 32 German participles (e.g. *gerufen* 'called') and eight quadruplets of surnames with different onsets (English-r, English-w, English-other, German-r) with matched vowels in the stressed syllable. We constructed four experimental lists by paring names and participles, matching lexical frequency of the participle and its r-syllable across name types (frequencies from dlexDB, cf. Geyken, et al. (2012)). The vowel in the r-syllable of the participle differed from the stressed vowel of the names. Names and participles appeared in sentence-final position in declaratives. 140 fillers were added to the experimental lists, totaling in 172 trials. We tested 32 German speakers, with English proficiency of at least B2. They saw one sentence at a time and had 2 sec to produce it. They also completed an English proficiency test and a Flanker task.

The realizations of the relevant phones in the names and the participles were annotated manually ([w], [ɹ], other approximant, [ʁ], other), using broadband spectrogram and auditory information. Preliminary results from 21 participants show that [ɹ]-intrusions are infrequent and only ocurred in the English-w and English-other conditions, contra Schlipf (2017), who used more English code-switches. Taken together, it appears that the frequency of English code-switches in an utterance and the activation of the English phonology in general predict [ɹ]-intrusions into German.

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Bilinguals Share Syntax Unsparingly

Heeju Hwang (University of Hong Kong), Jeong-Ah Shin (Dongguk University), & Robert J. Hartsuiker (Ghent University)
heejuhwang@gmail.com

Previous research suggests that bilinguals share syntactic processes and representations for constructions similar in two languages (actives/passives). However, languages often use different constructions to convey the same meaning. For example, the meaning of a causative construction in English (*Jen had her computer fixed*) is conveyed using an active transitive construction in Korean (*Jen-NOM her computer-ACC fixed*). Yet, little is known about how bilinguals represent and process such constructions. The present study aims to address the issue by investigating how Korean-English bilinguals represent cross-linguistically different constructions (causatives) in comparison to cross-linguistically similar constructions (transitives). There are, broadly speaking, two accounts of bilingual syntactic processing: the shared-syntax account and the separate-syntax account. The *shared-syntax account* suggests that (1) bilinguals share syntactic representations between languages and (2) the grammatical rules of one language influence syntactic processing in the other (e.g. Hartsuiker et al., 2004). In contrast, the *separate-syntax account* (e.g. De Bot, 1992) suggests that bilinguals store and access syntactic information separately for two languages. We evaluate these two accounts.

Experiment 1 investigates how Korean-English bilinguals represent transitive structures using between-language structural priming. If syntactic processes and representations become shared for transitives in L1 and L2 as a function of proficiency (*shared-syntax account*), proficient Korean-English bilinguals should show a stronger between-language priming effect than less proficient bilinguals. By contrast, if syntactic representations are separate in L1 and L2 (*separate-syntax account*), we do not expect any priming between Korean and English. Consistent with previous research, our results showed that proficient Korean-English bilinguals exhibited a stronger priming effect than less proficient bilinguals, providing support for the shared-syntax account. **Experiment 2** investigates how Korean-English bilinguals represent causative constructions that are different in the two languages. We paired a causative event (*Jen having her computer fixed*) either with an active transitive (*Jen fixed her computer*) or a causative sentence in English (*Jen had her computer fixed*), and asked participants to decide whether the given sentence matches the depicted event (picture-sentence verification task). If syntax is shared between L1 and L2 (*shared-syntax account*), a causative event should activate both causative (via its link in English) and active structures (via its link in Korean). Crucially, as transitive structures become shared between Korean and English (Exp1), the shared-syntax account predicts that a strong link between a causative event and an active structure in Korean should increasingly cause Korean-English bilinguals to mistake an active construction for an appropriate description of a causative event in English. However, if bilinguals develop distinct syntactic representations for causatives (*separate-syntax account*), Korean-English bilinguals should be more likely to reject than accept an active structure as a correct English description of a causative event. Our results showed that proficient bilinguals were indeed more likely to *accept* an active structure (as well as a causative) as an appropriate description of a causative event than less proficient bilinguals, providing support for the shared-syntax account. Taken together, our results suggest that bilinguals share syntactic processes and representations for both similar and different constructions, indicating that the bilingual system is highly integrated.

Crosslanguage Experiments on the Production and Perception of Prosody

Martin Ho Kwan Ip, Anne Cutler
The MARCS Institute; ARC Centre of Excellence for the Dynamics of Languages

How prosody is used to convey discourse-level information can vary dramatically across languages (Ladd, 2008). Direct crosslanguage comparisons are needed to test for language-universal mechanisms that could play a role in prosodic processing. We here examined the relative roles of universal vs. language-specific factors in the production and perception of prosodic focus by native speakers of English and of Mandarin Chinese. In our production studies, we aimed to create a substantial database of focussed and unfocussed realisations of the same words using structured dialogues that were both relatively naturalistic and closely matched across the two languages. Participants (24 English; 24 Mandarin) performed five of these dialogues in their native language, with each dialogue containing pairs of the same words occurring in a focussed and unfocussed context. Across the dialogues, English and Mandarin speakers were alike in their manner of production; all speakers realised focussed words with longer duration, greater intensity, higher pitch, and more exaggerated pitch range relative to the unfocussed words. However, there was also crosslanguage variation where Mandarin speakers increased their pitch to a greater extent, while English speakers showed a higher increase in intensity.

In a follow-up phoneme-detection task, participants (42 English; 52 Mandarin) heard sentences in their native language and responded as fast as they could to a target sound [p^h]. Reaction times (RT) in Mandarin were facilitated in sentences where the preceding intonation contour predicted accent at the location of the target-bearing word compared to sentences without predicted accent on the target word (p = .026), even though the same neutrally realised target word occurred in both cases. In line with findings from Germanic languages (Akker & Cutler, 2003), our data show that Mandarin speakers entrained to preceding intonation to locate the semantically most central part of the utterance, although this is a language where prosodic cues to focus in prefocus regions can be preempted by tonal movements. However, the extent to which predicted accent facilitated RT was twice as high in English (p < .001). At the same time, acoustic analyses of the English stimuli revealed that the preceding contours in predicted accent sentences had longer duration, higher pitch, and more extended pitch range, whereas the Mandarin stimuli only showed a greater pitch range. Thus, prosody may be universally available for processing focus, while the extent of its use and its precise realisation may be considerably language-specific.

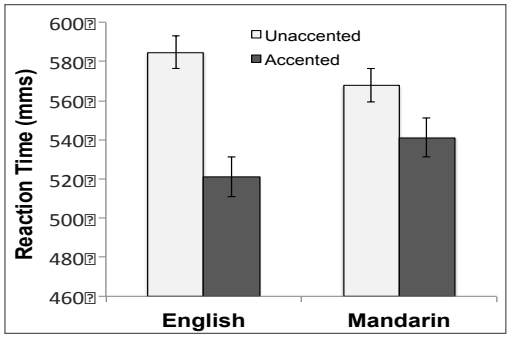


Figure 1. RT as a function of accented vs. unaccented context. Error bars represent standard errors

Table 1. Mean RT (mms) to Target [p^h]

	Reaction Time		
	Accented	Unaccented	*t*
Mandarin	521.06 (110.99)	584.68 (105.66)	2.30*
English	541.19 (171.71)	567.81 (177.31)	4.00***

Note. *p < .05, ***p < .001. Standard deviations are in parentheses below mean

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Effects of language production on prediction: Word vs. picture visual world study.

Aine Ito[1]<aine.ito@ling-phil.ox.ac.uk>, Max S. Dunn III[2] & Martin J. Pickering[2]
[1]University of Oxford, [2]University of Edinburgh

Under production-based models of language prediction (e.g., Pickering & Garrod, 2013), people use their production system for prediction, and an enhanced use of the production system is likely to facilitate prediction. We tested this hypothesis by comparing people's predictive eye movements when they did or did not shadow sentences. We argue that shadowing should facilitate prediction but interfere with integration, because prediction and production share mechanisms while integration and production do not.

Native British English speakers listened to sentences containing a highly predictable word (cloze *M* = 98%) while viewing words (Experiment 1, *N* = 48) or pictures (Experiment 2, *N* = 48) representing the predictable target (***bee***), its phonological competitor (***bean***), or an unrelated distractor (***cat***). Half of the experiment involved the shadowing task and half the listening task (blocked, order counterbalanced). If people predict the target word (and its phonology), they should predictively look at the target (and the competitor). If people use the production system for prediction, shadowing should facilitate these predictive looks.

The analysis on the prediction time window (-800~200ms) showed that a fixation bias towards the target occurred earlier in the shadow vs. listen task in Experiment 1, while this effect occurred similarly early in both tasks in Experiment 2. The competitor effect occurred earlier in the shadow vs. listen task in Experiment 2, but there was no competitor effect in Experiment 1. In the integration time window (200~1000ms), the bias towards the target was reduced in the shadow vs. listen task in Experiment 1, and the bias towards the competitor was reduced in the shadow vs. listen tasks in Experiment 2.

Earlier predictive eye movements in the shadow vs. listen task support prediction by production. Thus, production can facilitate prediction, but it may be affected by the type of context in which comprehension takes place.

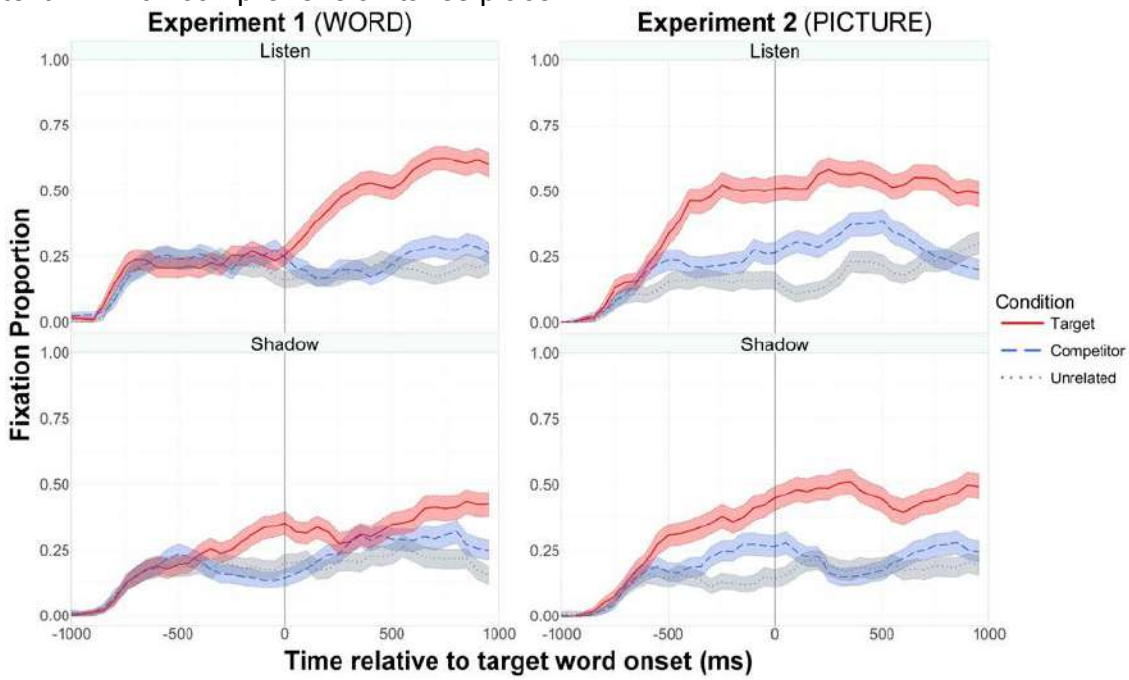


Figure. Fixation proportion on critical words or pictures in the listen (top) and shadow (bottom) tasks.

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Effects of associative (sequential) learning across speech perception, speech production, reading, and typing

Gary Jones, Jens Roeser, Harriet Smith, Paula Stacey, Mark Torrance (all Nottingham Trent University). All authors made equal contributions.

Humans have an undoubted propensity for learning associations across stimuli. As a sequential stimulus, language is perhaps the most uncontroversial domain where associative learning is at work. Indeed, there is ample evidence of the effect of associative and statistical learning on language, such as mapping object labels to referents (Hay, Pelucchi, Graf Estes & Saffran, 2010) and acquiring syntax (Kidd, 2012). Nevertheless, exactly how widespread the effect of statistical learning is on different linguistic processes and whether the same effects are seen across these processes remains unclear. In this paper we examine whether associative learning is apparent across the four basic domains of language processing (reading, writing, speech production and speech perception) and if so, how the subsequent processing of linguistic stimuli is affected.

24 high frequency target bigrams (e.g., *pocket money*) were extracted from the British National Corpus that occurred 150 times or more and that did not exist in their reverse format (zero frequency target bigrams e.g., *money pocket*). Filler items were also extracted that did not appear as a bigram with any of the target bigram words. For speech perception, 48 four-word (filler *target bigram* filler e.g., teacher *pocket money* principle) segments were spoken aloud in background noise (DV = proportion correctly recalled). For speech production, the four-word segments were displayed on screen with spoken recall accuracy recorded. For typing, the four-word segments were typed immediately after their presentation. For reading, two blocks of the four-word segments (one high frequency, one zero frequency) were flanked by additional fillers with fixation duration recorded. For reading and typing, an intermittent recognition task also took place.

Across all tasks there was an effect of bigram frequency, though this was evidenced in different ways. Relative to zero-frequency bigrams, a greater number of high frequency bigrams were perceived, produced and typed, while reading showed shorter first-fixation durations for the first word of a high frequency bigram. Processing of high frequency bigrams also facilitated processing of the following fillers, with a greater number of fillers being perceived and produced. Analysis of the recognition task showed that in both cases, words from high frequency bigrams were better remembered than those from zero-frequency bigrams, with no effect on recognition of the fillers.

We show that statistical learning has an effect for the same words across four different language domains. Moreover, the processing of high frequency bigrams facilitates the processing of subsequent language stimuli. Interestingly, this latter effect is not also borne out in the recognition data, illustrating that while there is an immediate processing advantage for stimuli appearing after a high frequency bigram this is not retained after the particular word set has been processed. Our results provide further support for the idea of now-or-never processing in language stimuli (Christiansen & Chater, 2016).

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Motor and auditory cueing of attention and syntactic choice.

Mikhail Pokhoday, Yury Shtyrov, Christoph Scheepers, and Andriy Myachykov

In a fully developed production system, perception provides an input of information about the event, attention foregrounds relevant/important information for the conceptual analysis, and subsequent language production mechanisms collaborate to generate speech (Levelt, 1989). A part of this complex process is the necessity to select between simultaneously available syntactic alternatives. For example, English language provides several options that can describe the same visual event, e.g., an officer chasing a burglar. These minimally include (1) The officer is chasing the burglar and (2) The burglar is (being) chased by the officer. These active- and passive-voice alternatives differ in assigning object and subject roles to agent (officer) and patient (burglar). Existing evidence suggests that the system responsible for assigning the grammatical roles is sensitive to the distribution of the speaker's attention within the described scene (Tomlin & Myachykov, 2015, for a recent review). Specifically, a speaker of English is more likely to choose a passive-voice frame when her attention is directed to the patient of the described event and she is more likely to use an active-voice frame when the agent is in her attentional focus (e.g., Myachykov, et al., 2012). While this and other studies indicate a regular interplay between attention and syntactic choice, they also exclusively used variants of the visual cueing paradigm (Posner, 1980). As a result, the reported link between attention and syntactic choice cannot be generalized beyond the visual modality.

A more ecologically valid proposal needs to take into account a multi-modal nature of attention. Here, we report results of a sentence production study, in which English native speakers described visually presented transitive events (e.g. kick, chase, push). In half of the trials the agent appeared on the left and in the other half – on the right. Speakers' attention to the referents was manipulated by means of a lateral cue. The cue was either auditory (beep played monaurally) or motor (participants were prompted to press a left or a right key depending on the color of the central fixation cross). Hence, the Cued Referent (Agent/Patient) was crossed with the Cue Type (Auditory/Motor). The proportion of the produced passive-voice sentences was the dependent variable. First, we replicated previous findings by registering a main effect of Cued Referent (more passive-voice sentences in Patient-Cue condition: $X2(1) = 5.29$, $p=.02$). Second, there was a main effect of Cue Type (more passive-voice sentences in Motor-Cue condition: $X2(1) = 6.56$, $p=.01$). Third, there was no interaction between the two factors suggesting that only one attentional modality at a time can impact syntactic choice. Overall our findings replicate previous findings using visual cueing paradigm and extend them to auditory and motor modalities.

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Contextual effects on the processing of the Hungarian focus construction

Tamás Káldi, Research Institute for Linguistics – HAS
Anna Babarczy, Department of Cognitive Science – BME

Hungarian has a special syntactic position for focus: the focused element is immediately pre-verbal and gets the most prominent sentential stress (preVf). Regarding preVf's interpretation, there is a consensus that it has (or tends to have) an exhaustive reading. Traditional generative theories claim that this reading is encoded in the sentence structure and that there is a deterministic relationship between preVf and exhaustivity (É. Kiss 2002), while pragmatic accounts propose that preVf is underspecified for exhaustivity, and its exhaustive interpretation depends on a number of factors (Wedgwood 2005). Indirect experimental results suggest that one of these factors is contextual restriction on the choice of alternatives (Káldi et al. 2016).

The present study investigates contextual effects on the processing of preVf in a visual world eye-tracking experiment. For comparison, lexically marked focus (only-f) and neutral sentences were also included. The test sentences were presented following two types of linguistic context: restrictive or non-restrictive. It was hypothesized that if preVf exhaustivity is encoded in structure, looking patterns will converge on the exhaustive target image at a similar rate in the two contexts, just as they do in the case of lexically determined only-f. However, if context has an effect on the emergence of exhaustivity in preVf, looking patterns should converge more slowly on the exhaustive target in the non-restrictive context than in the restrictive context; similarly to looking patterns with neutral sentences.

The results support the latter prediction: fixation patterns diverge in the case of both preVf and neutral sentences, while they do not in the case of the baseline only-f.

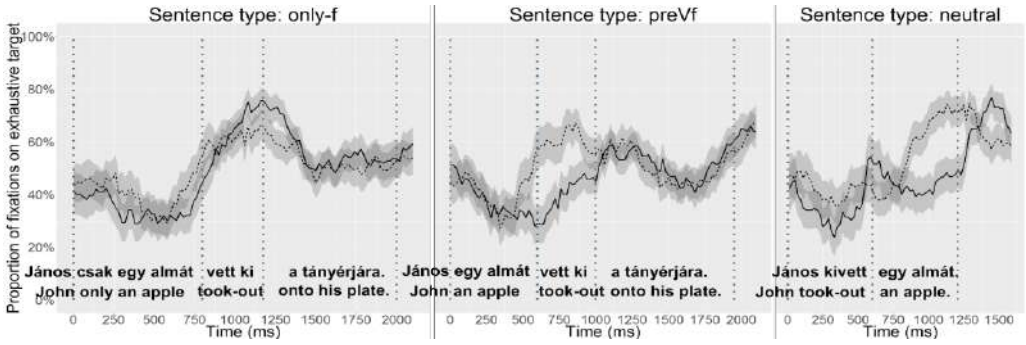


Figure 1: Proportion of fixations on exhaustive target (ribbons: SE). English text: calque
Dashed line: restrictive context, solid line: non-restrictive context

References

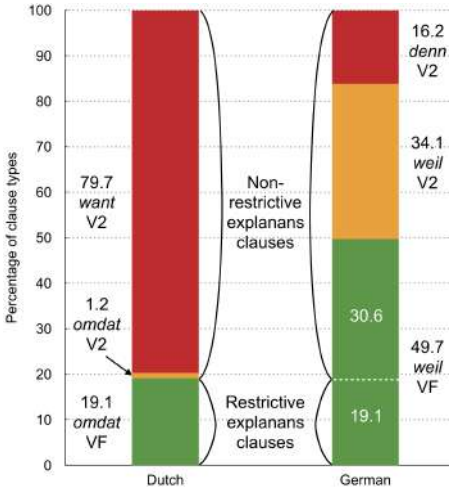
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A competitive mechanism controlling SOV vs. SVO order in Dutch and German

Gerard Kempen[a] *& Karin Harbusch*[b]
[a]*Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands*
[b]*Computer Science Department, University of Koblenz-Landau, Koblenz, Germany*

In Dutch and German, the order of Subject, Object(s) and finite Verb in main clauses differs from that in subordinate clauses: SVO (verb-second, V2) and SOV (verb-final, VF), respectively. This occasions grammar lapses by speakers selecting the incorrect (noncanonical) order. A familiar example is the choice of SVO in causal/explanatory clauses introduced by a subordinating conjunction (after Du. *omdat* and Ger. *weil* 'because'). This phenomenon, called *omdat/weil*-V2, may be due in part by the parallel existence of causal clauses with a coordinating conjunction (Du. *want* and Ger. *denn* 'for, since'). These lapses occur only in clauses (henceforth "explanantia") that FOLLOW the main clause ("explanandum") in extemporaneous SPOKEN language, and there is no mirror image *want/denn-VF* phenomenon. In addition to the syntactic distinction between coordinating vs. subordinating explanans clauses, there is a pragmatic distinction between RESTRICTIVE and NONRESTRICTIVE clauses (Quirk et al. 1985:1075-77). Explananda with a restrictive explanans express ONE assertion; those with a nonrestrictive explanans express TWO assertions. This also holds for English, e.g. *I got a ticket, for I was speeding* (NONRES; two assertions) vs. *I didn't get a ticket because I was speeding* (RES; one assertion). Crucially, *want/denn* are exclusively NonRes; *omdat/weil* are either Res or NonRes. Hence, the SOV/SVO and Res/NonRes distinctions do NOT coincide. (The Res/NonRes distinction corresponds to "at-issueness" vs "not-at-issueness of the clausal content; cf. Charnavel 2017.)

In a new corpus study, we compared the incidences of *omdat/weil*-V2 lapses in a German and a Dutch spoken language corpus (the treebanks VERBMOBIL and CGN; for methodological details, and references, see Kempen & Harbusch 2016, 2017). The data confirm (as expected) that noncanonical *omdat*-V2 occurs regularly (in about 6% of the *omdat* clauses), but—unexpectedly—is much rarer than *weil*-V2: *omdat*-V2 occurs in 1.2% of ALL Dutch explanantia whereas *weil*-V2 occurs in 34.1% of all German explanantia. The figure also shows that the relative frequency of *want* is four times higher than that of *denn* (79.7 vs. 16.2%).



Theory. We propose an account in terms of a simple feedforward neural network consisting of two layers of mutually inhibitory nodes (winner-takes-all competition): a LEXICALIZATION layer (enacting competition between coordinating vs. subordinating conjunctions), which feeds into a LINEARIZATION layer (competition between SVO vs. SOV). Restrictive conceptual input selectively activates subordinating conjunctions in the Lexicalization layer. Nonrestrictive input activates coordinating as well as subordinating conjunctions in the Lexicalization layer, but also SVO in the Linearization layer directly (preactivation). The default activation levels of the conjunction nodes covary positively with their relative frequencies. Moreover, we assume that speakers of German and Dutch produce similar proportions of NonRes and Res explanantia (ratio around 4:1).

We show that a neural net based on these assumptions can generate the observed data. This result supports the applicability of inhibitory competition as a general mechanism controlling the selection of word order alternants (cf. a proposal by Kempen 2014).

Prosodic constraints on grammatical encoding in written but not spoken production

Gerrit Kentner & Isabelle Franz, Goethe-University Frankfurt

A speech production experiment by Lee & Gibbons (2007, henceforth L&G) suggests that speakers use the unstressed optional complementiser *that* to optimise rhythmic alternation of weak and strong syllables, as it is more often produced when the top of the complement clause (CC) starts in a stressed (*Susan*) as opposed to unstressed (*Suzanne*) syllable (1).

(1) Henry knew (that) {Susan, Suzanne} washed the dishes.

L&G take this finding to support models of language production in which phonological encoding influences the grammatical encoding stage. However, since there is no obvious syntactic difference between CCs with and without *that,* it remains unclear whether *that*-omission does affect grammatical encoding or whether it is simply phonological deletion.

In contrast to English, the presence or absence of the complementiser in German necessarily engenders a marked syntactic difference concerning the position of the finite verb within the CC (underlined in 2). In an attempt to replicate and adapt L&G to German, we devised 32 sentences like (2) with eight embedding verbs which permit optional *dass*, systematically varying the structure of the CC with (2a) or without (2b) *dass*, ii) the stress position of the embedding verb (e.g. *sagt* vs. *sagte*) and iii) of the proper name of the CC.

(2) a. Rita sagt/sagte, dass Karlo den Abwasch macht *(verb-final subord. clause)*
b. Rita sagt/sagte, Karlo macht den Abwasch *(verb in 2nd position)*
Rita says/said (that) Karlo does the dishes

We adhered closely to the protocol by L&G: participants (n=32) first silently read a filler sentence, then a target sentence like (2), and were then to produce first the filler then the target sentence from memory. Less than 55% of the target sentences were usable responses; there was no significant effect of either verb or noun stress on the use of *dass*.

In experiment Two, we substituted the filler sentences by a simple arithmetic task. This time, 95% of responses by 32 different participants were usable. Again, neither stress on the verb nor the noun significantly affected complementiser inclusion/omission.

For experiment Three, we combed a newspaper corpus (TüPP-DZ) for occurrences of CCs starting in a proper name and embedded under any of the eight embedding verbs. We hand-coded the stress position of the proper names and the embedding verbs of the 1476 hits with and the 1275 hits without *dass*. We find a significant effect of verb stress on the use of *dass* in the predicted direction (more omissions after verbs with an unstressed final syllable; $z=4.3$, $p<0.001$). Less frequent proper names lead to fewer omissions ($z=3.02$, $p=0.003$), as did – against predictions - names with an unstressed initial syllable ($z=-2.08$, $p=0.04$). The length of the proper name did not significantly affect the results.

As the rhythmic influences on complementiser omission/insertion do not appear to translate to spoken production in a language in which complementiser use engenders a clear syntactic difference, we assume that phonological effects on grammatical encoding may be indirect and only observable in kinds of language production that are less constrained by time (as e.g. newspaper prose or poetry).

Reference: Lee, M. W., & Gibbons, J. (2007). Rhythmic alternation and the optional complementiser in English. Cognition 105(2).

Contrastive inference across discourse

Christina S. Kim and Louisa Salhi, University of Kent

How standards of comparison for scalar adjectives like *small* are established based on context has been actively researched [1-2, a.o.], but much of this work sets aside the question of which contextual cues comprehenders rely on to determine an appropriate comparison class, and how different cues are weighed against each other. The present study uses the Visual World Paradigm [3] to investigate how comprehenders integrate visual and discourse cues to referentially disambiguate an expression like *small square*. It builds on [4], which demonstrated the effect of visual contrast on reference resolution.

Exp1 asks to how discourse (DC) and visual contrast (VC) are integrated when both are present and provide conflicting cues to contrast. Participants heard sentence pairs like *'Click on the large square. Now, click on the small square'* accompanied by pairs of displays containing a target referent (large/small square) and three other shapes. The VC effect [4] was replicated: when a contrast set was in the visual context, fixations converged on the target before the target word onset. DC also facilitated referential disambiguation: when both VC and DC were present, contrast set members competed with each other, as indicated by later target convergence in 2-contrast conditions (DC targets: 100-200ms post target onset, $t=2.15, p<.05$; VC: 300-400ms post target onset, $t=2.23, p<.05$), than 1-contrast (DC targets: 300-400ms post target onset, $t=2.09, p<.05$). Fixations were fit with mixed-effects logistic regression models (analysis windows: pre-adj, adj-to-target, post-target). There were more competitor fixations for 2-contrast than 1-contrast conditions in the adj-to-target ($\beta=.042, p<.0001$), post-target windows ($\beta=.071$, SE=.0027, $p<.0001$). However, DC competitors gave rise to a weaker competitor effect than VC competitors: there was a larger competitor advantage for VC competitors in both adj-to-target ($\beta=.034, p<.0001$) and post-target windows ($\beta=.047, p<.0001$). Despite this, DC must often be more salient than VC in richer discourses [5-6]; prior patterns of reference also influence expectations about subsequent reference [7-8].

Exp2 asks whether prior experience describing classes of items modulates the strength of discourse or visual cues to contrast. Participants were initially trained to categorize one class of objects (3D shapes, e.g. cube) by size, and another (2D shapes, e.g. square) by pattern (striped/solid). The test block included two-contrast conditions where the competitor was from a different training category than the target (e.g. *'Click on the small sphere. Now click on the striped square'*). If experience associating different category members with particular modifiers leads to expectations that the same conventions will continue to be followed, different category competitors should be weaker competitors to the target than same category competitors. There were more competitor fixations for same-category than different-category competitors in the adj-to-target ($\beta=.053, p<.0001$) and post-target windows ($\beta=.053, p<.0001$), suggesting unexpected modifier-category pairings were weaker competitors than expected ones. However, within different category conditions, comprehenders recovered more slowly from DC (600-700ms post target onset, $t=2.72, p<.01$) than from VC competitors (200-300ms post target onset, $t=2.43, p<.05$). This may be due to the DC competitor requiring comprehenders to shift from one dimension of modification (e.g. *small/large*) to another (e.g. *striped/solid*) within a discourse (3-4); this suggests comprehenders may expect that, regardless of category-specific modification history, speakers will modify discourse referents in consistent ways.

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Metrical Context Affects Word Recall

Amelia E. Kimball, University of Illinois at Urbana Champaign
Duane G. Watson, Vanderbilt University

It has been claimed that English has a regular metrical structure in which stressed and unstressed syllables alternate (Nespor & Vogel, 1989), and metrical regularity has been shown to facilitate online language comprehension (Quené & Port, 2005). Evidence of a regularity advantage is surprising, however, given research showing that metrical regularity is uncommon in conversational English (*e.g.* Temperley, 2008). Furthermore, it is unclear whether this advantage extends beyond online tasks. The present study examines the effects of metrical regularity on a recall memory task to test a) whether there is a psychological reality to metrical structure, and b) whether metrical structure has consequences for long-term comprehension.

Recall was tested for metrically regular or irregular lists of words in three experiments. In each experiment, participants heard recordings of 52 lists of nine words. Participants could play each list once. After participants heard the list, they were presented with a textbox to report all the words they recalled in any order. The order of the lists was randomized. Sixty participants recruited from Amazon Mechanical Turk performed each experiment online and were paid $5. All were self-reported native English speakers with normal hearing. The experiment was a within-subjects design.

In Experiments 1 and 2, the critical manipulation was the presence of a target word that matched or mismatched the other words in the list (See Table 1), while in Experiment 3 the metrical pattern switched half way through the list, so that the metrical pattern of the first half of the list differed from that of the the second half.

Table 1: Example items from all four conditions, Experiment 2

pattern	regularity	left context	target	right context
SW-SW-SW	regular	**penguin, illness, husband, picture**	**nickel**	**chapter, zebra, coffee, dresser**
WS-WS-WS	regular	estate, domain, buffoon, croquet	giraffe	descent, prestige, amount, latrine
SW-WS-**SW**	irregular	**virus, mountain, hamster, music**	giraffe	**photo, fire, journey, minute**
WS-**SW**-WS	irregular	array, consent, parade, haiku	**nickel**	critique, ellipse, attempt, chauffeur

Note: SW words are in bold

For each experiment, recall accuracy was analysed in a mixed effects logistic regression. Fixed effects included metrical regularity of the entire list (regular vs. irregular), pattern of surrounding context (SW vs. WS), word status (whether the word was a target or not), and all two- and three-way interactions. Results of Experiment 1 show that a word that *mismatches* its surrounding context in a metrical pattern is more likely to be recalled. Experiment 2 confirms that this effect persists using more acoustically controlled stimuli. Experiment 3 similarly shows a positive effect of irregularity on recall; all words in the irregular condition were better recalled than words in the regular condition.

Although this work used word lists rather than sentences, these results support two conclusions about metrical regularity: first, listeners are sensitive to metrical patterns in a memory task, and second, irregularity advantages memory retrieval downstream. We offer two possible explanations for this result. One explanation is that irregularity is more common in spontaneous speech, and therefore irregular speech is both easier to recall. Alternatively, differing metrical structures across words in the irregular condition make each individual word more distinctive, and thus, easier to recall.

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The role of sleep in phonological generalisation in childhood

Knowland, V., Fletcher, F., Walker, S., Gaskell, G., Norbury, C., & Henderson, L.

Generalisation is critical to language acquisition: from the ability to apply one label to multiple referents to the generalisation of morphological affixes. Fenn and colleagues have suggested that, for typically developing adults, sleep promotes the generalisation of phonological mappings after listening to synthesised speech[i]. After training, adults showed enhanced generalisation to novel synthesised tokens, an effect which was ameliorated 12 hours later, only to be restored to post-training levels by sleep.

The aim of the current study was to assess the role of sleep in generalisation during phonological learning in children with and without Autism Spectrum Disorders (ASD), with language ability varying across both groups. The role of sleep in phonological learning is particularly relevant in children with ASD, as this population shows elevated levels of chronic sleep disturbances[ii] and highly variable phonological development.

Participants completed four sessions: Session One in the morning of Day 1, Session Two in the evening of Day 1, Session Three in the morning of Day 2, and Session Four approximately four weeks later. During Session One, participants were initially tested on their recognition of 25 familiar nouns, synthesised by Votrax[iii]. Participants were then trained on 125 tokens using a 2AFC paradigm, during which they had to repeat each synthesised token, were then immediately played a clear token, followed by the synthesised token once more. After training, participants were again tested on their recognition of 25 untrained tokens as well as 25 tokens from the training set. This test of novel and trained items was repeated at Sessions Two, Three and Four. During the night after Session Two participants' sleep was monitored using EEG and actigraphy.

On average, children showed a 34% increase in performance on Novel, untrained items immediately after training. No group differences were observed in initial performance or training effects. Children without ASD showed the hypothesised reduction in performance over the day, followed by a restoration of performance after sleep. By comparison, children in the ASD group did not show any significant changes in performance from session to session. This finding suggests that sleep may support phonological generalisation in children without ASD but not in those with the disorder. Results will be discussed with reference to the time course of phonological generalisation and the role of sleep behaviour and sleep architecture in learning across our sample of children with varying language skills. The role of different sleep stages will be discussed, particularly REM, which is believed to be important for generalisation in typical adults[iv], and which is reduced in adults with ASD[v].

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The dyslexic brain before and after literacy - unifying structural signs

Ulrike Kuhl, Angela D. Friederici & Michael A. Skeide

Department of Neuropsychology, Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany

Longitudinal studies following children from a preliterate age on are the gold standard for disentangling potential causes from consequences of dyslexia (Goswami, 2015). Here we overcome power limitations of recent pioneering work (Clark et al., 2014) by examining one of the largest longitudinal samples ever studied (N=16 children developing dyslexia, N=16 matched controls). Moreover, we extend the scope from cortical thickness to multimodal measures of cortical surface anatomy, including folding, gyrification and sulcus depth. Crucially, we unify these indices in a single multivariate model using an innovative random-forest classification method (Breiman, 2001). Our results reveal a co-occurrence of transient effects only present at a kindergarten age and continuous effects persisting into second grade. While transient differences (maximum accuracy: 85%) were observed in the left occipito-temporal cortex close to the "visual word form area" (Skeide et al., 2016), persisting differences were observed in phonological processing areas (superior temporal sulcus) (maximum accuracy: 82.5%) (van Attefeldt et al., 2004) and semantic processing areas (angular gyrus) (maximum accuracy: 90%) (Carreiras et al., 2009). This is in line with large-scale behavioral studies identifying phonological awareness (Ziegler et al., 2010) and rapid automatized naming (Moll et al., 2014) as most reliable predictors of literacy skills. These findings illuminate the developmental dynamics that ultimately lead to the most common learning disorder.

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How do violations of Gricean maxims affect reading?

Kumiko Fukumura (University of Strathclyde) & Roger van Gompel (University of Dundee)
kumiko.fukumura@strath.ac.uk

Research on syntactic ambiguity resolution suggests that language users have strong Gricean expectations about optimal informativeness (e.g., Altmann & Steedman, 1988). However, subsequent off-line rating studies (e.g., Engelhardt, Bailey, & Ferreira, 2006) indicate that the conclusions from those studies may not generalize to sentences without syntactic ambiguity. Hence, three eye-tracking reading experiments examined the time-course with which the violations of the Gricean maxims affect comprehension processes in syntactically unambiguous sentences.

In Experiment 1, 40 participants read sentence (2a-b) after (1a-b). The bare noun in (2a) was ambiguous following (1b) (two-referent), but not following (1a) (one-referent). The size adjective in (2b) was redundant following (1a), but not following (1b). The *ambiguity-first* hypothesis predicts that initial comprehension difficulty arises because readers cannot identify the referent uniquely. Hence, whereas ambiguity should immediately disrupt reading, redundancy should not. The *redundancy-first* hypothesis assumes that initial reading difficulty arises when readers fail to identify *at least one referent* that is compatible with the description of the referring expression. Size adjectives signal the presence of a referential contrast; if they occur in the one-referent context, immediate difficulty should arise, as the processor fails to identify the contrast signalled by the modifier. Consistent with the latter, first-pass times, regression-path times and total times for the modifier noun region were significantly longer in the one-referent than in the two-referent context. In contrast, ambiguity only increased total times for the bare noun region.

Experiment 2 examined the mechanism underlying the early redundancy effect by replacing size adjectives with color adjectives (*the white towel*). The *meaning-based early redundancy hypothesis* predicts that when size-modified noun phrases follow a one-referent context, the processor immediately slows down, because the semantic processing of the modifier requires a contrast set. In contrast, redundancy of color modifiers should not result in immediate difficulty, because their semantic processing requires no comparison set. Our results indeed showed that unlike redundant size modifiers, redundant color modifiers did not increase first-pass times; the redundancy of color adjectives only affected the total times of subsequent regions. Experiment 3 contrasted the redundancy effect in size and color adjectives within the same experiment. Consistent with the meaning-based early redundancy hypothesis, redundancy led to longer first-pass times for size-modified nouns, but not for color-modified nouns.

Our findings thus speak against the view that Gricean pragmatic expectations about optimal informativeness have an immediate impact on reading. Initial referential processing is primarily led by the semantic representation of the referring expression: ambiguous descriptions that allow the identification of at least one compatible referent do not immediately slow down reading, whilst modifiers that semantically imply a contrast impair comprehension immediately when the context contains no alternative. Ambiguity and redundancy of color modifiers have an effect only after referential processing has identified relevant referents on the basis of the meaning of the referring expression.

(1) a. There was one towel in the bathroom. (one referent)
    b. There were two towels in the bathroom. (two referents)
(2) a. The towel/was soaking/on the floor.
    b. The small towel/was soaking/on the floor.

Cantonese lexical tone perception and production by non-native speakers: from eyetracking and imitation tasks

Daniel T. Lee & Hintat Cheung
The Education University of Hong Kong

Relations between speech perception and production have received scholarly attention (Levelt, 2001), and more interestingly, the scope extends to discussions about L2. However, previous studies mainly examined segmental consonants and vowels but lexical tones which are particularly crucial in tonal languages are not well-studied relatively. Second, theories about L1 and L2 focus on the rationales behind L1 influences on L2 perception and learning (e.g., Best, 1993), but do not largely discuss the processing features and time-course. However, these mechanisms about where and how perceptual assimilation is likely operated are needed for understanding how non-native sounds are possibly processed at different stages (Baddeley, Gathercole, & Papagno, 1998).

The present study attempts to provide insights for these queries. Specifically, we investigated (1) whether speakers of a tonal language can perceive non-native tones well and fast, (2) which non-native tone contrasts are more challenging to perceive, and (3) whether speakers can produce native-like tones in fast imitation. The study examined 24 Cantonese as well as 24 Mandarin speakers who had no much prior Cantonese experience. For perception, we had 8 pairs of CVCV Cantonese disyllabic pseudo-words with 8 pairs of unfamiliar objects. Each pair involved a minimal tonal contrast (e.g., /bu1fa1/, /bu2fa1/). Eight filler pairs were added. An eye-tracking experiment was conducted with a visual-world paradigm, during which participants watched animated cartoons, perceived tonal contrasts in a word learning task, and looked at the corresponding object after it was named. The increase in looking times to the named target was obtained. For production, an imitation task using the 16 pseudo-words from the 8 contrast pairs was implemented and phonetically-trained native Cantonese raters gave 5-point scalar rating about the nativelikeness.

Results show that Mandarin speakers could generally perceive non-native lexical tones well and establish label-object mapping fast, but the processing operations may be different from native speakers as reflected by different perception patterns during the whole time-course. Specifically, non-native speakers processed slower than natives and used fewer strategies to perceive uncertain tones. And, the relative difficulty level of the tone contrasts was revealed. Difficult tone contrasts (e.g., tones 2 vs. 5, tones 4 vs. 6) and easy contrasts (e.g., tones 1 vs. 2, tones 1 vs. 6) were identified. Production results basically followed this trend. But Cantonese and Mandarin speakers had a different order of the Cantonese tone contrasts.

Discussions include (1) how L2 tones are perceived fast by L1 speakers of another tonal language, (2) whether perceptual models such as Best (1993)'s Perceptual Assimilation Model could predict the results between L1 and L2, (3) how perception and production performance are linked, and (4) how perception can be better situated and described in an incremental processing model.

Do beat gestures and prosodic prominence enhance preschoolers' recall and comprehension of discourse information?

Llanes-Coromina, J.; Vilà-Giménez, I.; Kushch, O.; Borràs-Comes, J.; & Prieto, P.

The cognitive benefits of co-speech gestures have been widely described. While positive effects of representational gestures have been described both for information recall and comprehension ([1,2,4,5]), much less is known about the benefits of beat gestures (or rhythmic hand/arm movements produced with prominent prosody) with controversial results in the literature ([6,7,3]).

This study investigated (a) whether beat gestures combined with prosodic information help children *recall* focused information in a child-directed discourse, as well as information related to it (Experiment 1) and (b) whether the presence of beat gestures helps children *understand* the content of a narrative (Experiment 2). In Experiment 1, fifty-one 4-year-old children were exposed to a total of three short stories with contrastive words presented in three conditions, namely *with prominence in speech and gesture*, *prominence only in speech*, and *non-prominent speech*. Results of a recall task showed that children remembered more words when they were presented with prosodic prominence and beat gestures compared to either of the other two conditions, and that children remembered the information better about the words that were presented accompanied by prominence in speech and gesture. In Experiment 2, fifty-five 5- and 6-year-old children were presented WITH six narratives either in the no-beat (i.e. with target items produced with prosodic prominence and no beat gestures) or the beat condition (i.e. with target items produced with prosodic prominence and beat gestures). Results of a narrative comprehension task demonstrated that stories told with beat gestures were comprehended better by the children rather than those performed without beats. Together, these results constitute evidence that beat gestures help preschoolers not only recall but also comprehend discourse information. Therefore, our work suggests that beat gestures enhance children's development of cognitive and linguistic abilities.

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Paradigmatic effects in Estonian inflected noun production

Kaidi Lõo, University of Alberta; R. Harald Baayen, University of Tübingen;
Fabian Tomaschek, University of Tübingen; Benjamin V. Tucker, University of Alberta;
Juhani Järvikivi, University of Alberta

Most current psycholinguistic models assume that the majority of inflected forms are processed as discrete morphemic constituents (Levelt et al., 1999; Pinker, 1999). Recent word recognition studies, however, challenge this assumption by suggesting that the information about individual inflected forms, and paradigmatic relations is available in the long-term memory (Milin et al., 2009; Lõo et al., 2017).

To shed light on this issue in production, we conducted a word naming study with Estonian case-inflected nouns. Estonian is a Finno-Ugric language with a large number of inflected forms (800,000 in a 15-million token corpus). Interestingly, these forms do not exist in isolation, but they are organized into extensive inflectional paradigms (up to 50 inflected words sharing a lemma), and morphological families (up to 1,000 derived and compound words sharing a constituent). This organization seems to play a crucial role in Estonian lexical processing.

The current study investigated how the whole-word frequency, the size of inflectional paradigm, and morphological family size affect word naming, specifically, speech onset time and articulation duration. In Experiment 1, 26 native speakers of Estonian (18 female; 21-67 years) read aloud 200 isolated case-inflected words. We found that words with higher frequency, and more paradigm and morphological family members were produced faster and in shorter time. In Experiment 2 with 2,800 items and 33 participants (20 female; 22-69 years), similar effects were found. However, they were stronger in general.

In summary, the current study is in line with previous studies showing paradigmatic effects in lexical processing. It extends our knowledge in three important ways. First, we established that the whole-word frequency effect for inflected forms is present for all inflected nouns words, not only irregular. Second, we replicated the well-established effect of morphological family size in an another domain — production of case-inflected nouns. Third, we documented that a novel paradigmatic measure, inflectional paradigm size, is not specific to word recognition only.

These results are in line not only with linguistic theories like Word-and-Paradigm morphology (Blevins, 2006) but also with discriminative models (Baayen et al., 2011), and indicate that the amount of information about word use in the mental lexicon might be substantially larger than previously assumed.

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Lexical selection and cognitive control in children with SLI, ASD and ADHD

Ágnes Lukács[1], Annamária Csomó[1], Anna Sudár[1], Enikő Ladányi[1,2]
1 Budapest University of Technology and Economics, Department of Cognitive Science
2 Université Paris Descartes Laboratoire Psychologie de la Perception

The paper examines the proposal that domain general cognitive control abilities (CC) play an important role in the resolution of linguistic conflict (eg. Novick et al., 2010) by presenting results from three developmental disorders that show a differential pattern concerning these cognitive functions. Specific Language Impairment (SLI) involves evident impairments in language, and is often, but not always associated with impairments in CC. Autism Spectrum Disorder potentially, but not necessarily involves deficits in both language and CC, and Attention Deficit Hyperactivity Disorder is defined by inefficient CC, and either no problems with language, or mild deficits in this domain. Performance of children in the clinical groups (SLI n=13, ASD n=10, ADHD n=10) in all three cases are compared to results from age and IQ matched typically developing children. We aimed to examine in these three disorders with different cognitive profiles whether individual differences in different measures of cognitive control are associated with performance on a language tasks involving competing representations

According to the lexical competition hypothesis competition can arise during word retrieval which has to be resolved with the help of cognitive control processes (Schnur et al., 2006). A picture naming task was designed to show the effect of conflict on word retrieval and performance in this task was compared to performance in cognitive control tasks for determining the specific types of cognitive control processes which are needed for lexical conflict resolution. The level of conflict was manipulated by (1.) the context of the pictures (semantically homogeneous vs. mixed blocks) and (2.) the number of possible names of the picture (high vs. low naming agreement). Competition (and, consequently, naming time) is expected to be higher in the case of homogeneous vs. mixed as well as low vs. high agreement pictures because in the previously named semantically similar words in the first case and other possible names of the picture in the second case become competing alternatives which have to be inhibited. Results showed higher RT-s in case of homogeneous vs. mixed as well as low vs. high agreement conditions in SLI and TD children, but not in children with ADHD and in children with ASD. Performance on the naming task and on measures of CC were not associated in any of these groups. taken together, our results argue that conflict resolution in lexical tasks is not dependent of domain-general processes of cognitive control.

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The effect of animacy on children's online processing of relative clauses

Ross Macdonald[1], Ludovica Serratrice[2], Silke Brandt[3], Elena Lieven[1], Anna Theakston[1]
[1]University of Manchester, [2]University of Reading, [3]Lancaster University

Subject relative clauses (SRCs, "the deer *that is chasing the cow"*) are processed more easily than object relative clauses (ORCs, "the deer *that the cow is chasing"*), but this difference is diminished by the presence of an inanimate head-noun (Mak, Vonk, & Schriefers, 2002). We investigated the influence of animacy on children's and adults' online processing of SRC and ORC sentences. Forty-eight English-speaking children (aged 4;5–6;5) and 32 adults listened to sentences that varied in the animacy of the head-noun (Animate/Inanimate) and the type of relative clause (RC) used (SRC/ORC). Concurrently, while eye movements were monitored, participants saw two images of the same two agents, carrying out reversed actions (e.g. deer chasing cow/cow chasing deer, Figure 1) and were asked to match the picture to the sentence using a game-pad.



Fig 1: Animate and Inanimate condition images – The head nouns were "deer" and "tractor"

Both child and adult participants were quicker to respond to SRC sentences and children were more accurate with SRCs (adult performance reached ceiling). As expected, children were significantly more accurate with ORCs with an inanimate head-noun rather than an animate head-noun, but animacy had no effect on the response time for ORCs.

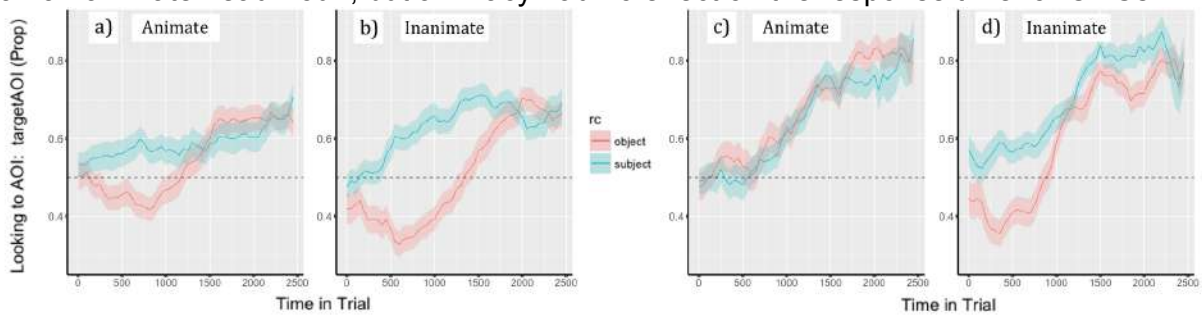


Fig 2: The proportion of looks to the target for children (a, b) and adults (c, d). Time 0 is the onset of the RC, e.g. "that is chasing the cow" (SRC) and "that the cow is chasing" (ORC). Mean RC duration was ~2500 ms.

Surprisingly, for SRCs, after the onset of the RC ("that…") children made more looks more quickly to the target in the inanimate rather than animate condition (Figure 2), suggesting greater anticipation for SRCs with inanimate head-nouns. Similarly, adults showed no preference for looks to the SRC-picture in the animate condition but they did in the inanimate condition, although this preference emerged earlier than it did with the children. The seemingly increased anticipation for SRCs in the inanimate condition may be due to surprisal at inanimate objects acting on animates, or it may be due to the inanimate objects being more distinct from their animate competitors and thus easier to locate more quickly. We are currently investigating these possibilities. Regardless of the cause, our results show that children were slower to attend to the ORC target in the inanimate condition, yet they performed better in this condition. This suggests that duration of looks to the visual target following RC-onset does not predict children's ability to process RCs.

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Representation and processing of semantically ambiguous words

Greg Maciejewski & Ekaterini Klepousniotou
School of Psychology, University of Leeds, UK

The vast majority of words are in some way ambiguous, such that understanding their representation and processing is central to any model of word processing. While the literature uniformly agrees that homonyms, words with unrelated meanings, have separate semantic representations and generally slow processing, there is much less consensus regarding polysemes, words with multiple related senses. Studies of polysemy are often contradictory, partly because they define this form of ambiguity either in terms of sense relatedness (e.g., Klepousniotou et al., 2008) or the number of word senses in a dictionary (e.g., Rodd et al., 2002). Here, we controlled for the latter to examine the comprehension of different ambiguous words in the absence of context.

Participants made relatedness decisions to word pairs involving homonyms with balanced meaning frequencies (e.g., “electric/sports fan”), metaphorical polysemes with literal and figurative senses (e.g., “wooden/authoritative chair”), metonymic polysemes with regular sense extension (e.g., “fluffy/marinated rabbit”), polysemes with irregular sense extension (e.g., “valid ticket/argument”), and completely unambiguous words (e.g., “lake”). Average subjective ratings of meaning/sense relatedness were high for metonyms (6.1 out of 7), moderate for irregular polysemes (4.5) and metaphors (4.6), and very low for homonyms (2.0). Target words were either related to the dominant meaning/sense, the subordinate one, or were unrelated.

The results revealed that sense relatedness, rather than sense count, had differential effects on the processing of ambiguous words. In particular, the processing of balanced homonyms and irregular polysemes was generally slower than that of unambiguous words. Like homonyms, irregular polysemes seem to have separate semantic representations that compete for activation, and therefore slow comprehension (e.g., Rodd et al., 2002). The processing of metonyms did not entail such competition, most likely due to a single semantic representation for these words (e.g., Frisson & Pickering, 1999). A processing cost arose only when the word pairs instantiated the subordinate sense of metonyms, pointing to additional processes involved in deriving that sense from the core representation (Klepousniotou et al., 2008). A similar but greater effect was observed for metaphors. These words seem to have a single semantic representation only for the dominant, literal sense, with the figurative sense being retrieved on-line in context.

Overall, the findings support the distinction within polysemy and show its differential effects in word comprehension. Further studies should contrast different ambiguous words across a number of language-processing tasks to provide a more adequate and consistent account of the representational and processing nature of these words.

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Abstract Concepts, Situations, and Perceptual Information

Ken McRae, Daniel Nedjadrasul, Raymond Pau, Bethany Pui-Hei Lo, & Lisa King
Department of Psychology and Brain & Mind Institute, University of Western Ontario, London, Canada

A common observation is that abstract concepts like *learn* differ from concrete concepts such as *chair* or *apple*. They typically are defined by this difference, in terms of being "entities that are neither purely physical nor spatially constrained" (Barsalou & Wiemer-Hastings, 2005). Due to their lack of obvious physical or perceptual referents, abstract concepts often are thought to be represented predominantly through linguistic co-occurrence or word association (Crutch & Warrington, 2005). In contrast, we argue that abstract concepts are not devoid of perceptual information because knowledge of real-world situations is an important component of learning and using many abstract concepts. Although the relationship between perceptual information and abstract concepts is not straightforward, situation-based perceptual knowledge is part of many abstract concepts.

Experiment 1 investigated whether pictures corresponding to real-world situations facilitate processing abstract concepts. Participants made lexical decisions to words denoting abstract concepts that were preceded by related and unrelated pictures of situations. For example, *share* was preceded by a picture of two girls sharing a cob of corn. When the picture was presented for 500 ms, decision latencies were only 2 ms shorter for abstract words preceded by related versus unrelated pictures. However, when the picture was presented for 1000 ms, decision latencies were a significant 19 ms shorter for abstract words preceded by related pictures. Given that the abstract words referred to concepts that corresponded to the picture as a whole, rather than, for example, a single concrete object or entity in the picture, it takes time for this relational processing to occur.

Experiment 2 tested whether abstract words facilitate processing pictures of situations. For example, reading the abstract word *victory* might activate knowledge that corresponds to a certain degree to triumphant-looking individuals. This knowledge might then facilitate the response when viewing a picture of such a scene, as opposed to the picture being preceded by an unrelated word like *share*. On each trial, an abstract word was presented for 250 ms, followed immediately by a picture. Participants indicated whether or not the picture showed a normal situation (filler pictures were used such as a woman pulling a violin from a fresh fruit aisle in a grocery store). Decision latencies were 82 ms shorter for pictures preceded by related as compared to unrelated abstract words.

Concepts and the words denoting them are learned, comprehended, and produced in context. Our experiments provide evidence that knowledge of events and situations may be important for learning and using at least some types of abstract concepts. That is, abstract concepts are grounded in situations, but it is more complex than for concrete concepts. Furthermore, the idea that events and situations are important for abstract concepts is not necessarily tied to grounded cognition in its strong forms. In addition to sensory and motor information that is experienced during real-life events, people's understanding of abstract concepts certainly also includes knowledge that is gained from language describing situations and events for which those concepts are relevant.

Barsalou, L. W., & Wiemer-Hastings, K. (2005). Situating abstract concepts. In D. Pecher & R. A. Zwaan (Eds.), *Grounding cognition: The role of perception and action in memory, language, and thinking* (pp. 129–163). Cambridge: Cambridge University Press.

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How universal are prominence hierarchies? Evidence from native English speakers

James Michaelov, Jennifer Culbertson, and Hannah Rohde (University of Edinburgh)
james.michaelov@gmail.com

The term prominence hierarchy has been used to refer to a ranking of nouns by how likely they are to fulfil the agent or patient semantic role in a sentence. Prominence hierarchies have been used to explain a variety of linguistic phenomena such as split ergativity and inverseness (see Lockwood & Macaulay, 2012, for an overview). In general, explanations for prominence hierarchies tend to involve functional constraints or cognitive biases (Lockwood & Macaulay, 2012), and as these accounts generally aim to explain crosslinguistic similarities in the hierarchies, the factors that these explanations rely on tend to be non-language-specific, such as the cognitive accessibility of referents (Bickel & Nichols, 2007) or how natural it is to imagine the event from the viewpoint of one of the referents (DeLancey, 1981). This raises an intriguing possibility: that prominence hierarchies are represented in the minds of speakers of all languages, even if their language does not explicitly encode prominence in its grammar.

The aim of the present study was to investigate this possibility. We test native English speakers, and target the difference between first and third person. Previous crosslinguistic research suggests the first and second person consistently rank above the third person in prominence hierarchies (Lockwood & Macaulay, 2012); a relation which is not explicitly encoded in the grammar of English. In the experiment, participants (N=53) were presented with a past-tense sentence of the form verb-pronoun-pronoun, with one pronoun in the first person and the other in the third person (matched for case, e.g., 'HIT SHE I', 'LEFT HIM ME'). They were asked to determine which of the pronouns was the 'doer' of the action.

The results, shown in Fig. 1, show that participants interpreted the first person pronoun as the 'doer' (agent) more often than the third person pronoun, in both the nominative and accusative case, and both when the pronoun was immediately after the verb (Position 1) or at the end of the sentence (Position 2). Likelihood ratio testing confirmed that this result was statistically significant – the location of the first person pronoun in the sentence had a significant effect on which pronoun was picked as the 'doer' ($\chi^2(1) = 75.79$, $p < 0.0001$). This preference for first person as 'doer' was also influenced by case.

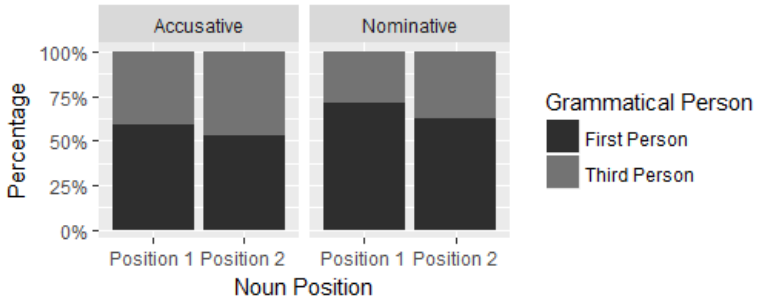


Fig. 1 Grammatical person of pronoun picked as 'doer'

These findings suggest that native speakers of English are indeed sensitive to prominence distinctions between first and third person, even though English does not explicitly encode this relation in its grammar. In other words, English speakers implicitly assume that a first person event participant is more likely to be an agent than a third person participant. This is consistent with the claim that prominence hierarchies are represented in the minds of speakers of all languages. The exact nature of these mental representations, how they are acquired, and what other effects they may have on language processing and production, are matters for further research.

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The Effect of Contents Shadowing Training on Articulation Rates for Japanese EFL Learners

Hiroshi Nakanishi (h.naka@tscc.tohoku-gakuin.ac.jp)
Tohoku Gakuin University, Sendai, Japan

English shadowing (SH) training requires students to repeat auditory input speech immediately after listening to it, in order to improve their English listening skills. Listening comprehension involves phonological, lexical, syntactic, semantic, and pragmatic processing. Since each process consumes finite working memory (WM) resources, efficient processing is critical to successful listening comprehension.

SH is often classified into two types: prosody SH and contents SH. Prosody SH requires learners to pay attention to input sounds (i.e., individual sounds and language melody), whereas contents SH requires learners to attend to the meaning of the input. Many studies on prosody SH have yielded useful data that can be applied to improve phonological processing skills (i.e., sound perception skills and rehearsal efficiency) (Kadota et al, 2016).

This study focuses on how contents SH affects the performance of rehearsal efficiency and whether that performance differs according to the type of contents SH by directing participants' attention to various aspects of language processing (i.e., semantic, syntactic, and pragmatic).

A sample of 32 Japanese English-language learners was divided into four groups so that the average fluency of each group was not significantly different based on the Oxford Quick Placement Test. Each group completed one of four types of SH training: (1) Standard SH training: Participants were required to simply repeat oral input shortly after listening to the model sounds. (2) Semantic SH training: A Japanese translation-verification task was incorporated into the standard SH. (3) Grammaticality SH training: A grammaticality judgement task was incorporated into the standard SH. (4) Pragmatic SH training: A pragmatic judgement task was incorporated into the standard SH. Each version of SH training included 15 sentences that were orally presented by an American native speaker of English at a rate of 135 words per minute. Before and after SH training, participants were required to read aloud a target sentence. SH training sessions and reading aloud tests were implemented on a computer, and the participants' voices in SH training and oral reading tests were recorded.

The results of the study showed that reading aloud speed improved significantly through contents SH training ($F(1,64) = 7.855, p<.01$) regardless of the type of contents SH, as has been shown to be true of prosody SH training in previous studies.

Accordingly, even if teachers direct students' attention to syntactic aspects during SH training in order to improve their syntactic processing skills—which is the most cognitively demanding aspect of language processing for Japanese EFL learners (Nakanishi & Yokokawa, 2011)—their rehearsal efficiency in phonological WM improves.

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Interactions between sentences and emoticons in text processing: ERP evidence

Yunju Nam & Upyong Hong (Konkuk University)

In on-line and mobile communication environments, messages typically include both texts and emoticons (Walther & D'Addario, 2001). To investigate how these two media interact with each other, this study used an electrophysiological method (i.e. ERP) and tried to figure out whether one is more powerful than the other and how emoticon contributes to the emotional evaluation of the communication messages.

We constructed 8 experimental conditions by manipulating the emotional types of sentence (Positive/ Negative), forms of sentence (Affirmative/ Negated) and types of emoticon (Positive/Negative) as well as 2 types of filler condition consisting of a neutral text with a positive or negative emoticon. All verbal texts were normed by an emotion rating task before the ERP experiment, as described in Table 1. Total 480 text-emoticon pairs (40 targets x 8 conditions + 160 neutral fillers) were presented to 17 Korean speakers (9 female / mean ages 23.5) in RSVP. Brain responses were recorded at the emoticon. Participants judged the emotional value of the preceding text-emoticon pair 500ms after the emotion offset.

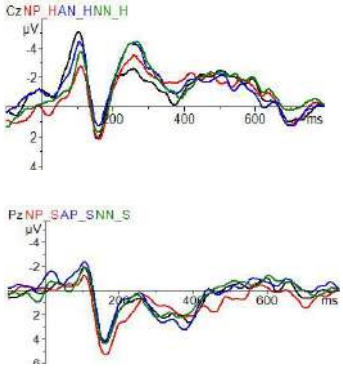
As ERP results, N400 was elicited only at the positive emoticons following negative sentences(AN & NN-Positive Emoticon(PE)) compared to the positive emoticons following positive sentences(AP & NP-PE) in 200-400ms, whereas no effect was elicited at the negative emoticons following positive sentences(AP & NP -NE) compared to the negative conditions(AN & NN-Negative Emoticon(NE)). This result indicates that the negative value (especially in text) plays a pivotal role in processing emotional messages. When a positive emoticon is following negative sentence, people detect emotional incongruence between the two, resulting in the N400. From the emotional category judgment task shown in Table 1, we can infer that people tend to retain the negative emotion in mind in the AN & NN-PE condition (more in NN-PE condition). Meanwhile, when a negative emoticon is given after a positive sentence (AP & NP-NE), people rather integrate the emotional value of two messages synthetically (no ERP response), and the emotional value of the whole message is even changed into the negative one (25% in AP-NE, 35% in NP-NE).

Conclusively, the emoticon interact with emotional value and type of sentence and once the emotional value is determined from a negative text, people hardly change its value even if a positive emoticon follows. This means that people process a positive sentence with a negative emoticon as an ironical expression.

Table 1. Conditions, Text norming score (emotional value of sentence) & Percentage of POSITIVE response in emotional judgment on sentence with emoticon

Factors		Con.	sentence norming score	Examples		
Emotional type	Sentence Type					
Positive	Affirmative	AP	1.81	나는 지난 여름 수영대회에서 우승을 했다. ***"I won the swimming competition last summer."***	98%	75%
	Negated	NP	3.05	나는 지난 여름 수영대회에서 꼴찌를 하지 않았다. ***"I didn't come last in the swimming competition last summer."***	92%	65%
Negative	Affirmative	AN	6.02	나는 지난 여름 수영대회에서 꼴찌를 했다. ***"I came last in the swimming competition last summer."***	13%	8%
	Negated	NN	5.66	나는 지난 여름 수영대회에서 우승을 하지 못했다. ***"I didn't win the swimming competition last summer."***	9%	6%
Fillers(Neutral)			3.43	나는 창 밖의 나무를 도화지에 그렸다. ***" I drew the trees outside the window on the canvas."***	-	-

Table 2. ERP results at positive (above) and negative emoticon (below)



Talker generalization of accent adaptation: Questioning its robustness

Lauren Oey, Crystal Lee, Emily Simon, Xin Xie & T. Florian Jaeger, University of Rochester

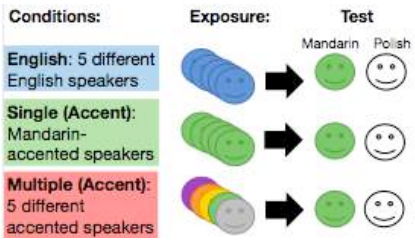


Fig.1. Exp.1. Design. Exps.2-3 exclude Multiple Accent Condition & Polish Test

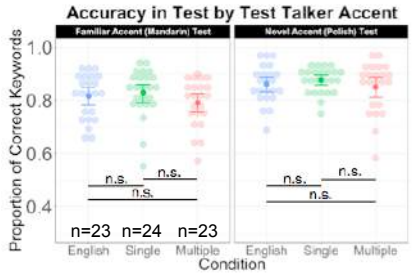


Fig.2. Results from Exp.1

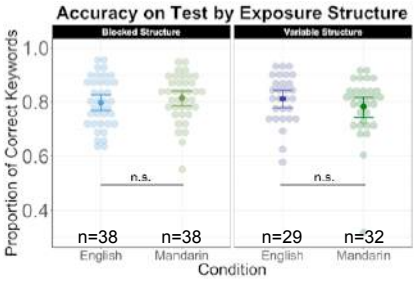


Fig.3. Results from Exp.2

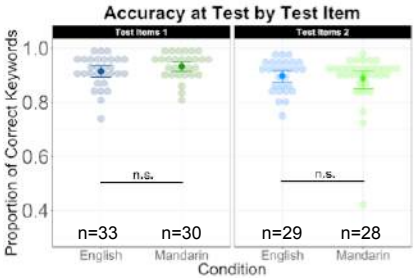


Fig.4. Results from Exp.3

Increased globalization has intensified demands on listeners to comprehend extensive variability in speech, such as that of foreign-accented speakers. Evidence suggests that listeners rapidly adapt to accented speech[1], and can generalize adaptation to novel speakers.[2,3] However, the scope of generalization, as well as its underlying mechanism, are still unknown. To investigate this question, we present a series of transcription task experiments on same-accent and cross-accent cross-talker generalization, across a range of learning contexts. Due to a surprising failure to replicate same-accent cross-talker generalization in Exp. 1, we present two experiments to further investigate this effect.

Methods: All participants (n=327; see Figs.) were recruited through Amazon Mechanical Turk. We measure listener transcription accuracy of keywords in selected test sentences from a novel Mandarin-accented speaker.

In **Exp. 1**, listeners are assigned to one of three accent exposure conditions (Fig.1). We hypothesize that listeners would best learn the systematic variability underlying accented speech, when exposed to the Multiple Accent Condition (> Single Accent > English), leading to greatest generalization. However, using a logistic mixed effects regression model, we find no difference in performance across all exposure conditions on either test speaker. Surprisingly, contrary to past findings[2,3,4], listeners exposed to the Mandarin-accented speech did not perform better than the English control.

Exp. 2 explores whether structure of the exposure phase (i.e. blocking by speaker vs. varying consecutive exposure item speakers) may facilitate generalization.[5] **Exp. 3** compares the dependency between exposure and test items presented, by including a test set that has shown generalizability in a recent study.[4]

Despite multiple experimental manipulations and a subject pool three times larger than in the original work[2], we consistently fail to find generalization of accent adaptation. There are two interpretations. One possibility is that there is an effect, but that effect is substantially less reliable than suggested by previous work. Alternatively, the specific speakers themselves, as opposed to variability in their accent, may be more important in facilitating generalization, in which case our speakers fail to constitute such a group. This hypothesis, often termed a “similarity-based” hypothesis has been considered, but dismissed, in the discussion of previous findings.[6] Our findings motivate the need for further research into this alternative hypothesis.

[1]Clarke & Garrett, *JASA*, 2004; [2]Bradlow & Bent, *Cognition*, 2008; [3]Baese-Berk, *JASA*, 2013; [4]Weatherholtz, Liu & Jaeger, *CUNY*, 2015; [5]Nygaard, *J Exp Psychol-Hum Percept Perform*, 2016; [6]Liu et al, *CUNY*, 2017

Identifying factors that influence the processing of collocations in Turkish and English: Evidence from corpus-based and experimental data

Doğuş Can Öksüz (Lancaster University, UK), Marije Michel (Lancaster University, UK), Vaclav Brezina (Lancaster University, UK)

So far, research on multi-word expressions (MWEs) focused mainly on the formulaicity in a narrow range of European languages, particularly on English. Therefore, our understanding about formulaicity as a general principle of language remains limited (Durrant, 2013), and thus more research is needed regarding typologically different languages. In this paper, we demonstrate that the formulaicity in agglutinating languages such as Turkish is different from the formulaicity in non-agglutinating languages. One of the reasons is that the rich morphology of an agglutinating language such as Turkish affects the frequency of occurrence and syntagmatic associations between lexical items. This study triangulates a corpus-based and a psycholinguistic approach to investigate the processing of two-word adjective-noun collocations in Turkish and English by L1 and L2 speakers of these languages.

First, with a focus on adjective-noun collocations we used corpus-based methods to explore relevant factors that are expected to affect the online processing of adjective-noun collocations in Turkish and English. Drawing on a general corpus of Turkish (TNC) with a size of 47 million words and English (BNC) with a size of 112 million, we identified that frequency of occurrence and collocational strength are relevant factors affecting the processing of collocations. Data suggest that (70%) of high-frequency and (75%) of mid-frequency bands collocations in Turkish occur at higher frequency than their equivalents in English at lemma level. We used different measures of collocational strength, that are, MI scores which highlight rare exclusivity; and Log Dice scores which detect exclusivity but not necessarily rare combinations (Gablasova et al. 2017). The two indices produced at times a conflicting picture of collocational strength for adjective-noun collocations of high-mid-frequency bands.

Second, we will present eye-tracking data of Turkish/English L1 and L2 speakers' processing of two-word adjective-noun collocations in their L1 and L2 Turkish/English to shed light on how the processing of collocations is affected by language-specific factors: frequency of occurrence and collocational strength. Combined results will reveal whether the corpus derived measures of frequency of occurrence, and collocational strength, as measured by MI and Log Dice are equally powerful predictors of the processing of adjective-noun in L1 vs L2 Turkish and English.

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Learning language with structured variation

LUCA ONNIS, Nanyang Technological University
SHIMON EDELMAN, Cornell University

A tacit assumption in Statistical Learning (SL) is that learners collect global statistics across the entire set of stimuli they are exposed to. For example, for implicit sensitivity to transitional probabilities to emerge, one must assume relatively extended exposure to frequency of several items across many instances. In naturalistic settings where the full scale of the input is experienced (e.g. a child learning a natural language), this assumption of global access to training data is problematic because it implies that the cognitive system must keep track of an exponentially growing number of relations while determining which of those relations is significant.

We investigated a more plausible assumption, namely that learning proceeds incrementally, using small windows of opportunity in which the *relevant relations* are assumed to hold over temporally contiguous objects or events. We tested this *local statistical learning* hypothesis in three independent experiments targeting the learning of three separate language-like tasks: the segmentation of artificial speech into word-like units (Experiment 1); the learning of novel arbitrary word-to-world mappings under conditions of uncertainty and fast mapping (Experiment 2); and the learning of predictive relations among non-adjacent pseudowords (Experiment 3). For each experiment adult participants were exposed to a miniature language adapted to each task, in one of two conditions: 1) a Structure Variation condition, in which the majority of trials were arranged in sequence such that one element was in common between two consecutive trials (elements were specific to each experiment), and 2) a Scrambled condition, in which a smaller proportion of consecutive trials contained auditory or visual overlap.

At test, all participants regardless of condition received the same test trials, half of which were structurally congruous according to training, and half were not. Importantly, because the two order conditions during training differed only in the order of trials, the *global statistics* of the miniature language were identical. This allowed us to make differential predictions. On the *global statistical learning* (GSL) account, learners solve the learning problem by keeping track of multiple statistics across many individually ambiguous stimuli across trials, possibly over the entire experiment. Thus, learning should not differ across our two conditions. Conversely, on the *local statistical learning* (LSL) account, learners benefit from the contiguous arrangement of partially overlapping trials and should therefore learn better in the Scrambled condition.

We found that in all three experiment temporal contiguity in Structured Variation conditions produce superior learning. A recently proposed theoretical framework, ACCESS (Goldstein et al., 2010) aims to explain the learning of structure in space and time in terms of general principles of cognitive computation. In agreement with those principles, our results suggest the effectiveness of temporal contiguity and contrast across three independent language learning tasks, namely a) speech segmentation, b) multimodal learning under conditions of uncertainty, and c) non-adjacency learning. The findings thus support the view that local statistical learning may be operating at different levels of language acquisition. In addition, the importance of order of presentation of learning materials has intriguing implications for various practical learning and teaching situations.

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What Big Eyes You Have: Pupillary Response to Intelligibility of Foreign-accented Speech

Vincent Porretta and Benjamin V. Tucker
University of Alberta

Foreign-accented speech is highly variable and leads to differences in intelligibility of the speech stream. Listeners handle this variability in everyday communication despite the challenge it can impose. However, it is also known that listeners can adapt over time to this variability, improving comprehension of foreign-accented speech (Bradlow & Bent, 2008). The current study examines spoken word processing (as measured by pupil dilation) of tokens varying in intelligibility due to foreign accentedness. Pupil dilation has been shown to measure cognitive processing load for auditory stimuli during speech perception (Beatty, 1982). Here, we aim to determine if pupillary response to accented speech corresponds to previous work examining the processing load induced by reduced intelligibility due to noise (Zekveld et al., 2010) and if this pattern is also influenced by experience with the accent.

The stimuli consisted of 40 monosyllabic English words spoken by five talkers (one native English, four native Mandarin) which were previously normed for intelligibility (Porretta & Tucker, 2015). In a listen-and-repeat task (Zekveld et al., 2010), participants heard a stimulus and repeated the word when prompted by a beep. Eighty-five native speakers of English were each assigned to one of five counterbalanced lists, ensuring each participant heard only one token of each word. Pupil size data were recorded (Eyelink II) along with spoken responses (digital recorder). Participants then completed a questionnaire assessing their experience interacting with Chinese-accented speakers.

Baseline normalized pupillary response was modeled as a time series (200−2000 ms post stimulus onset) using generalized additive mixed-effects modeling (Wood, 2016). This allows for the modeling of the inherent non-linearity and can account for autocorrelation in the data when examining the time course of pupil dilation across intelligibility and experience. Lexical frequency, trial, baseline dilation, and gaze coordinates were included as control variables, along with random curves for time by subjects and items. The results indicate a significant interaction between time, intelligibility, and experience, such that reduced intelligibility leads to greater peak dilation and sustained dilation in time. This pattern of peak dilation and duration was attenuated for participants with greater experience interacting with Chinese-accented talkers. Reduced intelligibility due to foreign accentedness appears to induce the same increase in processing load that is seen with other types of noise (see Zekveld et al., 2010). In addition, longer dilation duration was longer, indicating continued processing for less intelligible items. Lastly, prior experience with Chinese-accented speech reduces the overall processing load suggesting a generalized (though accent-specific) adaptation to accented speech variability.

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It's all about the head: Implicit causality effects on subject and object RCs

Céline Pozniak & Barbara Hemforth (LLF, CNRS, Univ. Paris-Diderot, Labex EFL)
celine.pozniak@gmail.com

It is well known in the literature that subject relative clauses (SRCs) are easier to process than object relative clauses (ORCs) in most languages, among those in French (e.g Frauenfelder et al, 1980; Holmes & O'Regan, 1981). Research focused mainly on syntactic factors like structural or linear distance or on semantics factors like animate/inanimate heads but not much attention was given to verb semantics. One factor that has been ignored is that the function of a relative clause is to provide an attribute of its head that serves (for restrictive RCs) to identify it in the current discourse universe. Thus, the focus of attention of any RC needs to be its head. From studies on implicit causality (e.g. Garvey and Caramazza, 1974; Kehler et al., 2008; McKoon et al., 1993), we know that verbs can put the attentional focus on the subject (NP1-biased: *Mary troubles Peter*) or on the object (NP2-biased: *Mary hates Peter*) of a sentence. We predicted that RC processing should become harder when the verb bias conflicts with the necessity of having the RC head in focus in particular for ORCs, i.e. subject-biased verbs should make the comprehension of ORCs particularly difficult since the head is the object of the sentence.

Therefore, we decided to run a series of experiments on French SRCs and ORCs varying the verb's implicit causality (IC) bias. Using a recently established corpus on IC-biases of French verbs (Mertz, Amsili, & Hemforth, in prep), we tested the influence of verb bias on the comprehension of relative clauses. We presented participants with 4 conditions (see [1]): 2 types of verbs (NP1-biased, NP2-biased) and 2 RC types (SRCs and ORCs).

[1] Example of sentences used for the acceptability judgment task

Subject relative NP1-biased verb	**Le professeur qui affole l'avocat** ne donnera plus ce cours au prochain semestre ***The teacher that frightens*** *the lawyer will not give class next semester.*
Subject relative NP2-biased verb	**Le professeur qui choisit l'avocat** ne donnera plus ce cours au prochain semestre. ***The teacher that chooses the lawyer*** *will not give class next semester.*
Object relative NP1-biased verb	**Le professeur que l'avocat affole** ne donnera plus ce cours au prochain semestre. ***The teacher that the lawyer frightens*** *will not give class next semester.*
Object relative NP2-biased verb	**Le professeur que l'avocat choisit** ne donnera plus ce cours au prochain semestre. ***The teacher that the lawyer chooses*** *will not give class next semester.*

In an acceptability judgment experiment (scale from 1=unacceptable to 10 fully acceptable, run on Ibex, 21 participants) and comprehension questions (e.g. who frightens the lawyer?), we found that object relative clauses with NP1-biased verbs were judged significantly less acceptable than all other relative clauses (Figure 1). This was also the only condition that lead to increased comprehension difficulty (71% correct compared to 84% correct on average for the other conditions). No significant difference was found between the two types of subject relative clauses. Interestingly, object relative clauses with NP2-biased are judged as acceptable as the subject relative clauses. Self-paced reading experiments are currently underway.

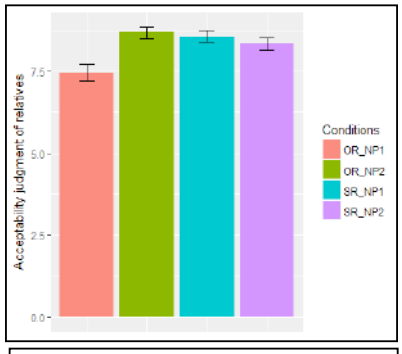


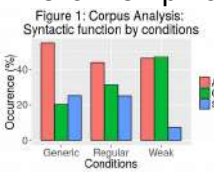
Figure 1. Acceptability judgment task on French relative clauses

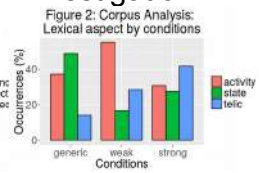
To conclude, our study showed that the verb semantics matters to understand RC processing and that ORCs can be as acceptable and easy to understand as SRCs with the right semantics. This is obviously an important confound that has not been taken into account in earlier experimental research on RCs.

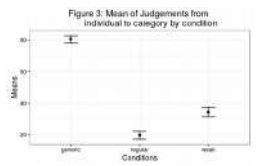
Are weak and generic the same kind of definite?

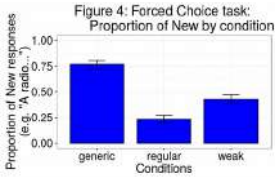
Thaís M. M. de Sá (UFMG/UFOP), Greg N. Carlson (University of Rochester), Michael K. Tanenhaus (University of Rochester/Nanjing Normal University)

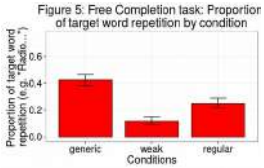
For the last few years there has been a productive debate about the proper semantics of "weak definites" (Beyssade and Oliveira, 2013). Carlson and Sussman (2005) proposed that some definites, which they termed "weak definites", lack the uniqueness property that is a defining property of regular definite noun phrases. In this investigation, we focus on Carlson et al. (2013) who propose that weak definites refer to events in "incorporated" structures, and mainly on Aguilar-Guevara and Zwarts (2013), who propose that weak definites in an incorporated structures are a generic DP and the noun denotes a kind, which accounts for its lack of individual reference. While those authors focus on formal descriptions, the current research is an empirical investigation which was designed to evaluate the hypothesis that weak definites are comprehended as generics. We conducted a corpus analysis in Brazilian Portuguese (BP) and 4 experiments in American English (AE), with the goal of comparing weak definite, regular definite and generic definite interpretations. In the corpus analysis, weak and generic definites did not show any positive evidence that could confirmed that they would be the same, with no complementary distribution in syntactic position (Figure 1) or lexical aspect (Figure 2). The experiments were based on the idea that the generic hypothesis predicts that weak definites and generics should pattern together, the incorporation hypothesis predicts that they all should pattern differently from each other. We constructed 54 sentences with an event or activity verbal phrase, 18 of which had an object that could have a weak, generic or regular interpretation. Experiment 1 used a sentence judgement in which 90 MTurkers would evaluate if the nouns in the sentences could be judge as an individual or a category, and weak definites were more similar to regular definites, as individual, and generics as category (Figure 3). Experiment 2 used a forced choice task, and generic definites showed a significant preference for a new noun continuation, which differs from weak (Figure 4). In experiment 3, we ran a free completion task, and the proportion of continuations with the repetition of the target word were less frequent on the weak condition, because they are incorporated (Figure 5). Experiment 4 used a forced completion task, and the bare plural form was only used in the generic condition (Figure 6). We argue that all results support that generic definites present a different pattern from weak ones, constituting a category of definite noun phrases.

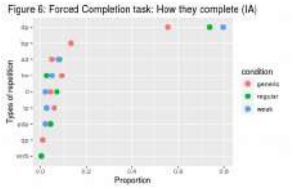












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Perception of geminate consonants by 4-9 years old Japanese children

Makiko Sadakata[1], Mizuki Shingai[2], Wencui Zhou[3], Mirjam Broersma[4], and Kaoru Sekiayama[2]

Donders Institute, Centre for Cognition, Radboud University Nijmegen, The Netherlands,[1,3]
Division of Cognitive Psychology, Kumamoto University, Japan[2]
Max Planck Institute for Psycholinguistics, The Netherlands[3]
Centre for Language studies, Radbout University Nijmegen, The Netherlands[3,4]

Geminate consonants (e.g. /tt/, /ss/) exist in various languages, such as Italian and Japanese (Kawahara, 2015). Recent study showed that Japanese native listeners tend to confuse between VCCV (e.g., /assu/) and V_CV (e.g., /a_su/, where "_" indicates a short silence duration), unlike Italian native listeners (Sadakata et al., 2014). One of the possible interpretations of such result is that Japanese native listeners segment geminate consonants into two parts, namely, a silence followed by a singleton consonant. However, inserting a non-existing silent duration when perceiving geminate consonants is a rather unusual strategy. A natural follow-up question is where this comes from. Interestingly, this segmentation strategy parallels to Japanese writing system, where geminate consonants are separated in two parts, the geminate sign (that is taught to represent a silent duration at school), followed by another symbol of a mora (that consists of CV or V). We are interested in studying if mastering of Japanese writing system is associated with their perception of geminate consonants. If so, the Japanese segmentation trend – the confusion between VCCV and V_CV – should increase as they get more fluent in Japanese writing system.

To this end, we tested perceptual abilities of Japanese native children with three age groups, 4-6yo(n=47), 7yo(n=29), and 9yo(n=29) in identification and discrimination of the VCCV and V_CV stimuli (e.g., /assu/-/a_su/). Identification and discrimination tasks took a form of the Dinosaurs word games (Zhou, 2015). Next to these, we measured their skills in writing and reading of words with and without the geminate sine, and Rapid Automatized Naming task (RAN, Wagensveld, et al., 2013).

One of the findings in our preliminary analyses is a significant positive correlation between RAN score and the confusion rate of VCCV and V_CV stimuli with 7yo and 9yo children. Because RAN is known to predict reading abilities, this may be partially confirming our hypothesis, namely, that getting more fluent in Japanese phonological system, possibly with mastering the Japanese writing system, is contributing to develop Japanese specific strategy in perceiving geminate consonants. Further results will be discussed in the light of this hypothesis.

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The interaction between implicit and explicit learning processes in the acquisition of 'do-support' in English.

In English syntax, the insertion of the auxiliary 'do' in interrogatives, negations and question tags, is commonly referred to as 'do-support'. In Brazil, there is anecdotal evidence that adult second language learners acquire this feature rather late in their syntactic development whereas some others never use it in written or oral production. This observation leads some linguists to believe that its acquisition is, at the least, inadequate. We report the results of an experiment that investigates weather alternating implicit learning activities with explicit instruction can lead to the acquisition of a structure similar to 'do-support'. Children, aged 11-12, in their first year of English education at school, were randomly split into two different groups and trained under two conditions. They were exposed to a semi-artificial language that mimicked the morphological and syntactic features of do-support in English. Subjects in the first group, with no formal instruction on this feature, received implicit learning activities by means of specially designed sentence building video games. The second group was trained on the same set of video games interspersed by a set of word animation screens devised to explain the target form. Though the animation screens used in the second condition are referred to as 'explicit instruction' in this study, they are admittedly different from the usual textbook-like set of rules commonly mentioned in the SLA literature. A grammaticality judgement test and the scores on the video games, which involved comprehension and production, were used to assess learning. The results are discussed in terms of the interaction between implicit and explicit processes in language learning.

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Senior moments. Physical fitness ameliorates age-related decline in language production

K. Segaert[1], S.J.E. Lucas[1], C.V. Burley1, A. E. Milner[1], M. Ryan[2], L. Wheeldon[3,1]
[1]University of Birmingham, UK, [2]King's College London, UK, [3]University of Agder, Norway

"Exercise keeps the mind sharp" is a type of headline we see frequently, in the news or social media. Indeed, previous research has established the benefits of regular physical exercise for cognition across different domains: memory, control, executive functioning and processing speed (Colcombe & Kramer, 2003). The underlying mechanism is that regular physical exercise improves aerobic fitness, which in turn is associated with benefits for brain structure and function (Voss, Vivar, Kramer, & van Praag, 2013). Surprisingly, no previous study has investigated the potential benefits of exercise for language, a core domain of cognition and one that is clearly susceptible to age-related decline.

We studied the relationship between aerobic fitness and tip-of-the-tongue states (ToTs). ToTs are indicative of a disruption in the transmission between meaning and phonology, and occur more frequently with age (Burke & Shafto, 2004). We had 27 young (mean age: 23 yrs) and 28 healthy elderly participants (mean age: 70 yrs). The elderly performed a graded aerobic fitness test on a cycle ergometer to measure maximal oxygen consumption (V̇O2Max), an objective physiological measure of aerobic fitness.

We found that healthy elderly indeed experience more ToTs ($p<.001$), and when they do, they have less access to correct phonological information ($p<.002$), compared to a young control group. Importantly, we found a linear relationship between aerobic fitness and word production abilities in the elderly: higher aerobic fitness levels decrease ToT occurrence in healthy elderly people ($p<0.014$), over and above effects of age, vocabulary size and controlling for education level (see Figure 1). Lifestyle factors such as aerobic fitness can thus help preserve aspects of language functioning in the elderly.

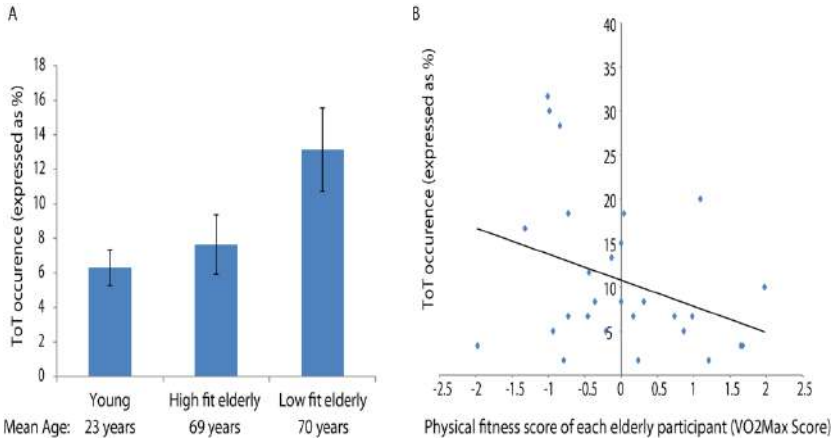


Figure 1. (A) A median split on the aerobic fitness scores of the healthy elderly reveals that ToT occurrence in high-fit elderly is higher than young adults ($p<0.003$) but lower than low-fit elderly ($p<.004$). High-fit and low-fit elderly did not differ in age, education level and vocabulary size (all $p>.3$) (B) The elderly showed a negative relationship between standardized aerobic fitness scores and ToT occurrence ($p<0.014$): the higher the aerobic fitness score, the lower the percentage of ToTs.

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Language Processing in the VWP: The Cost of Gaze Inspired Prediction

Mirjana Sekicki and Maria Staudte
Department of Language Science and Technology, Saarland University

Work in the VWP has established the link between eye-movements and language processing as reliable and systematic. Next to linguistic, the paradigm includes visual stimuli that present context relevant objects and inspire concrete prediction about upcoming referents. In addition, referential gaze cue can further reduce the set of potential referents and increase the predictability of the cued object. Expecting the gaze cue to induce a shift in the listener's attention to the cued object, we wondered whether such an attention shift simultaneously increases cognitive load while possibly decreasing the load on the upcoming referent.

Three eye-tracking studies in the VWP manipulated: the existence of the gaze cue (E1); the fit of the cue (and the referent) with the previous context (E2); and the cue's congruency with the upcoming referent (E3). Simple German sentences where played while displaying four objects, only two (E2: one) of which fit the verb selectional preferences. The gaze cue was introduced on the adverb. In addition to anticipatory eye-movements, employing a new pupillary measure of cognitive load, the Index of Cognitive Activity (Marshall, 2000, 2002), allowed us to measure the immediate cost of viewing the gaze cue and its potential benefit on processing the linguistic referent.

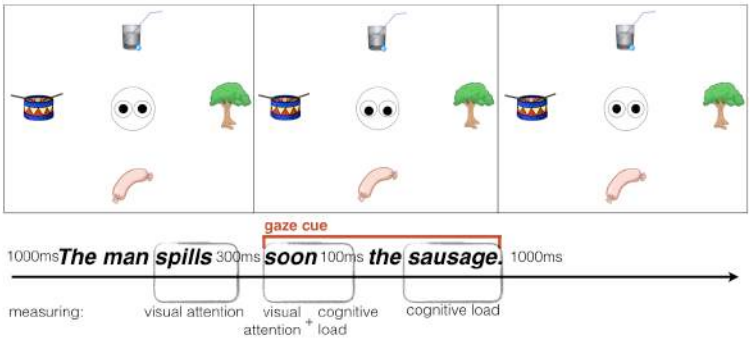


Figure 1: Trial timeline for a mismatching item from E2.

E1 used *congruent* gaze with *good fit*, and manipulated its existence. We found the cue to be followed, and to reduce the cognitive load on the referent (p = .023). No cost was found on the cue itself.

E2 used *congruent* gaze, but manipulated its fit to the previous context. Gaze led to a marginal facilitation on processing the referent (p = .054); while the cue itself was generally costly (p = .028), but only in the second part of the experiment. Initially, gaze did not have an effect on processing the referent; and only the mismatching cue induced higher cognitive load (p = .033). Participants gradually adapted to the mismatching cue and started making use of its informativity. Interestingly, the gaze cue was always followed.

E3 employed gaze cues of *good fit*, and manipulated its *congruency* with the referent. Gaze processing induced no cost, although the cue was thus, not fully reliable. We found a facilitatory effect of congruent gaze on referent processing (p = .028), but no cost for the incongruent cue (compared to no gaze). The eye-movements showed that the cue is always followed, but that the alternative fitting object in the scene is also activated.

Verb selectional preferences inspire activation of a/two visual object/s, while the gaze cue can additionally or alternatively activate an object. This shift in visual attention, however, does not block the verb-based activation; rather, both objects seem to stay activated. Importantly, in E2, attention shift patterns influenced by the gaze cue remain constant in both experiment parts, even though the cognitive load induced on the referent, i.e. how the cue is actually utilized, was significantly different. These findings suggest that patterns of anticipation do not necessarily directly reflect underlying processing patterns.

An ERP investigation of cue-based anticipatory processing in low constraint sentences

Kailen Shantz & Darren Tanner
University of Illinois at Urbana-Champaign

Robust and growing evidence strongly suggests that language comprehension employs predictive mechanisms, yet the conditions under which prediction occurs remain unclear (cf. Huettig, 2015). An emerging body of evidence shows that the extent to which individuals predict is modulated by numerous factors (e.g. Huettig & Janse, 2016). In order to obtain a comprehensive understanding of how predictive language processing is mediated by experience and cognitive abilities, however, it is further important to determine what linguistic cues are used to generate expectations, and *when* these cues are used for anticipatory processes.

To address this, we recorded EEG while native English speakers (N=32) monitored low constraint sentences for nouns, and made responses with their left and right hands when a particular noun occurred in a sentence. This allowed us to isolate the lateralized readiness potential (LRP) as an index of anticipation. We systematically varied whether target nouns were preceded by a verb or determiner that was informative about the identity of the noun via phonology or number marking (Table 1). We further manipulated between subjects whether cues reliably mapped onto the same response hand.

Table 1. Example stimuli illustrating all experimental conditions.

	Phonology	
	Match	Mismatch
Informative Cue (a/an)	Is that **an** owl/ant?	Is that **a/an** owl/cat?
Uninformative Cue (the)	Is that **the** owl/ant?	Is that **the** owl/cat?
	Number	
	Match	Mismatch
Informative Cue (is/are)	Where exactly **is** the bag/log?	Where exactly **is/are** the bag/logs?
Informative Cue (this/these)	Have you seen **this** bag/log?	Have you seen **this/these** bag/logs?
Uninformative Cue (modal + be)	That might **be the** bag/log.	That might **be the** bag/logs.

Results find that both participants with consistent and inconsistent cue-response mappings were reliably faster at responding when phonology provided an informative cue about the upcoming noun (B = 11.56, *SE* = 2.22, *t* = 5.22). In addition, LRPs on informative mismatch trials onset prior to the target noun for the consistent group, but not for the inconsistent group. Neither group showed behavioural nor electrophysiological evidence for the use of number marking as an anticipatory cue.

These findings indicate that phonological marking on the English indefinite determiners, *a* and *an*, can be used as an anticipatory cue to an upcoming noun. Results further suggest that the extent to which individuals anticipate or commit to a specific expectation depends on the ease of anticipating. Finally, data indicate that number marking may not serve as a robust anticipatory cue for upcoming nouns, though ongoing work is investigating whether this finding may be due to the lower relative salience of number marking as a potentially informative cue, and whether participants were encoding number information on the nouns.

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Optional modifier production and informativity in L1 and L2 speech

Zsofia Stefan & Agnieszka Konopka, University of Aberdeen
z.stefan.13@aberdeen.ac.uk

Contrary to the Gricean maxim of quantity, speakers tend to over-produce redundant modifiers in referential expressions [1,2]. Here we test whether production of such modifiers depends on their information value. Given that language processing is highly incremental, pragmatic speakers [3,4] may systematically produce more optional, redundant modifiers in early than later sentence positions to facilitate target identification for a potential listener (all else being equal). We use a complex shape naming task to track speakers' use of the visual context when planning modified and over-modified referential expressions online. We also compare performance of native (L1) and non-native (L2) speakers to test whether speakers are differentially sensitive to information supporting use of these modifiers when production requires lower (L1) or higher (L2) cognitive effort.

Experiment: Eye-tracked participants (20 L1 and 20 fluent L2 speakers) saw displays with six shapes (e.g., a row of three squares above a row of three triangles), and had to describe two shapes (targets) identified by an arrow (e.g., *the square above the triangle*). We manipulated the size of the target and non-target objects to elicit size modifiers for the first or the second target (*big square* vs. *big triangle*), determining whether the modifier occurred early or late in the utterance, and whether this modifier was (a) *unnecessary* for disambiguation (*big square/triangle* when all non-target squares/triangles were big), (b) *necessary* for disambiguation (*big square/triangle* when all non-target squares/triangles were small), and whether (c) it was *partially disambiguating* (*big square/triangle* in a context where one non-target square/triangle was small and one was big). Thus, all *unnecessary* modifiers produced in this context had no information value, the *necessary* modifiers were highly informative, and the *partially disambiguating* modifiers were informative in so far as they narrowed down the referential context from 3 to 2 plausible referents in one row of the display. Critically, these partially disambiguating modifiers were informative only when referring to the *first* object. Analyses of sentence form and eye movements compared production of these modifier types relative to utterance position (early vs. late) and fixations to targets in L1 and L2.

Results: all speakers produced *necessary* modifiers frequently (M>.92) and *unnecessary* modifiers very infrequently. Importantly, they also produced more *optional* modifiers to describe the first (M_{L1}=.54, M_{L2}=.83) than the second target object (M_{L1}=.33, M_{L2}=.40), and over-modification rates were higher in L2 than L1 (p<.05). L2 speakers maintained fixations on objects in one row of the display for a longer time before shifting their attention to the next row than L1 speakers. This pattern of careful inspection of the visual display in the order of object mention may be due to slower linguistic encoding in L2 but may allow inclusion of more optional modifiers in L2 than L1 utterances.

Discussion: speakers produced more partially disambiguating modifiers early than late in their utterances, supporting the hypothesis that differences in over-modification rates across sentence positions may reflect differences in the modifiers' communicative value. L1-L2 differences in modifier use suggest that the higher costs of L2 spontaneous production may be responsible for L1-L2 differences in utterance content. We discuss alternative explanations for this finding in terms of L1-L2 differences in metalinguistic awareness and sensitivity to addressee needs.

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Syntactic Processing Of Ambiguous Structures And Working Memory: Independent Or Interdependent Processes?

Noelia Ayelen Stetie[1] & Gabriela Mariel Zunino[2,1]
1 Universidad de Buenos Aires, Argentina
2 CONICET, Argentina

In current research on syntactic sentence processing, there is an ongoing discussion about the role of working memory in processing syntactically complex sentences that may have more than one structural representation, such as temporally ambiguous or *garden path* sentences. Some empirical studies argue that a decrease in working memory capacity brings problems for analysing structures that require a syntactic reanalysis, ergo, a more complex psycholinguistic process (Carpenter et al., 1994; Fiebach et al., 2005; Gordon, Hendrick & Levine, 2002; Vos et al. 2001). Other papers report evidence that syntactic processing of temporally ambiguous sentences would not be constrained by a decline in working memory capacity (Caplan, Michaud & Hufford, 2013; Véliz et al., 2011; Waters & Caplan, 2001).

In this study, we present the preliminary results of a pilot experiment with Spanish speakers. Our aim was to verify if a reduction in the working memory capacity results in a decrease in the efficiency of syntactic processing of garden path sentences.

Participants collaborated on a reaction time paradigm task that involved reading sentences in two conditions (ambiguous vs. unambiguous) with two types of adverbial clauses (place vs. time) segmented into five phrases and verifying correspondence with a sentence presented as a hole, immediately afterwards. Subjects also did the Rey Auditory Verbal Learning Test (Rey, 1958) which evaluates immediate free recall of a list of nouns, recall after interference, delayed recall and retrieval.

The preliminary results indicate that there is a negative correlation between the performance in the free recall task and the reading times of the critical constituents: subjects who obtained higher results in the Rey Auditory Verbal Learning Test also obtained lower reading times. However, this correlation occurs both in the syntactically ambiguous structures and in those that do not present any kind of ambiguity, which could suggest that the state of the working memory modulates the general syntactic processing, but does not have a particularly effect on the processing of garden path sentences.

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Accessing illicit antecedents with morphological cues during anaphora resolution

<Katja Suckow (Göttingen) and Clare Patterson (Köln)>

While memory is known to affect subject-verb dependencies, the role of memory for anaphora resolution is not clear even though both linguistic dependencies make use of agreement cues. Where LV05 [1] gives a detailed account of how cues from items not involved in the dependency can interfere with retrieval, yet memory effects, such as intrusion, have not been systematically found for anaphora resolution (cf. [2]). In [3] it is argued that the absence of such effects in reflexive anaphora resolution is because morphological cues are not employed in the resolution of reflexive anaphora, which rely on syntactic cues instead. The available evidence about the use of morphological and syntactic cues for memory retrieval in non-reflexive anaphora is inconclusive.

In order to further investigate interference from morphological cues in non-reflexive anaphora resolution, we have conducted an eye-tracking experiment in German (n=40). The experimental sentences (see (1)) each contained a conjoined noun phrase, made up of two nouns(“Musiker”/musician, “Referendar”/clerk), another single noun phrase (“Schüler”/student), and a pronoun. In all conditions, the only correct antecedent for the pronoun was the single NP. This is because it is unacceptable to refer to one of the nouns in a conjoined noun phrase using a singular pronoun. In all conditions, the gender of the pronoun matched the single NP. The gender match between the two nouns in the conjoined NP was manipulated across the four conditions (double match, NP1 match, NP2 match, no match). If morphological cues from illicit antecedents affect retrieval, as set out in LV05, there should be interference when these cues match the pronoun, and in this case resulting in longer reading times (double match > NP1, NP2 match > no match).

1. Der(Die) Musiker(in) und der(die) Referendar(in) trafen den Schüler, weil er den Plan besprechen wollte.
   The musician$_{fem/masc}$ and the clerk$_{fem/masc}$ met$_{plu}$ the student, because he wanted to discuss the plan.

The reading times showed an effect of NP1 match in regression-path times at the final region: there were longer times at the final region when the first noun in the conjoined NP was masculine (matching) than when it was feminine (mismatching). Similarly, there were marginal effects of NP1 match in the same direction in total reading times (anaphora region) and the same for the number of regressions-in (NP2 region). There were no effects of gender in the early reading time measurements and also no effect of the illicit NP2.

These findings suggest that an ungrammatical antecedent in a conjoined noun phrase might be considered during processing when it matches the gender of the anaphora, however this appears to affect later reading measures. The match effect partially confirms the predictions in [1] and is in line with [2]. This demonstrates that retrieval in non-reflexive anaphora can be affected by interference, despite the apparent constraint of conjoined NPs on reference.

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Two mechanisms of prediction updating that have consequences for the N400 on the predicted word.

Jakub Szewczyk, Institute of Psychology, Jagiellonian University

Previous research showed that reading an adjective whose gender marking is inconsistent with that of a highly expectable noun leads to an ERP effect on the adjective[1]. In this study we test whether the effect reflects the updating of predictions based on the information carried by the gender of the adjective.

We constructed 152 short stories. In the last sentence, each contained a direct object composed of an adjective and a noun (critical words). The stories were moderately constraining for the critical noun and many nouns were likely. The prenominal adjective was shown in either of the two grammatical forms: A) informative about the following noun, because its gender marking selected out the probable nouns that matched the gender, or B) less informative, because the grammatical marking did not disambiguate the gender of the following noun. Informativity was manipulated by alternating the number or the grammatical case of the direct object noun phrase. In Polish, the language of the study, there are syncretisms in adjectival inflection by number, case and gender. For example, in the plural accusative, most genders are expressed using the same suffix (i.e. they are uninformative), while in the singular the suffixes are unique for each gender. We hypothesized that if readers use the grammatical marking on the adjective to update their predictions about the upcoming nouns, the informative adjectives should elicit an ERP effect reflecting the update of prediction, while nouns following them should have a reduced N400 amplitude, relative to when the less informative adjectives are used. Moreover, both effects should be proportional to the degree of informativity of the adjectival suffix. Apart from the informativity of adjectives, we also manipulated whether the target nouns were semantically congruent with the stories. This allowed us to test for predictions regarding gender: Do adjectives unambiguously marked for gender facilitate the processing of a following noun carrying this gender, even if the noun is incongruent and thus could not be predicted?

36 participants passively read the stories while their EEG was recorded. An analysis of the ERPs showed that the informative adjectives elicited a negativity and its amplitude was proportional to the informativity of the adjective. The time-course and scalp topography of the effect depended on whether the noun matching the gender of the adjective was predictable or not. When there were likely nouns carrying the gender of the adjective, the adjective elicited a central, left-lateralised negativity in the 150-375ms time-window. When no likely noun carried the gender of the adjective, the effect occurred in the 280-575ms time-window, with a parietal distribution. In both cases, the noun had the N400 reduced proportionally to the degree of adjective informativity.

This shows that readers instantaneously update their predictions about the upcoming nouns based on the grammatical form of the prenominal adjectives. The distinct topographies and time-courses of the effects at the adjective suggest that two mechanisms updating predictions are used, depending on whether there are likely nouns consistent with the gender of the adjective. One mechanism is used to strengthen the activation of the already preactivated nouns. The other one is used to preactivate classes of words that have not been preactivated by the context.

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Concerning the notion of constructional polysemy

Enrico Torre
Independent Scholar

According to proponents of Construction Grammar, grammatical 'constructions' are inherently meaningful, independent of the lexical items they feature. Moreover, they are polysemous: each pattern is typically associated with several related senses, organized in a radial network, with a central sense and a few semantic extensions.

On the basis of a corpus-informed study of the so-called English 'caused-motion construction', I will call for caution on the radial network view of 'constructional meaning'. Indeed, an in-depth analysis of the data suggests that the distinction between different senses of a construction is less than ideal to do justice to the range of similarities and differences which characterize the many instantiations of this pattern, which seems to be better captured by a series of lower-level generalizations over distinct semantic configurations centered on the verb (cf. Boas 2003).

These lower-level generalizations include a number of different instantiations which share the same syntactic structure and but whose meanings are only connected by a series of overlapping similarities, and no one feature is common to all the sentences. As an example, consider the sentences in (1) below, which are supposed to instantiate the central sense of the pattern (X CAUSES Y TO MOVE Z) and those in (2), which are supposed to instantiate one of the radial extensions (X PREVENTS Y FROM MOVING Z):

(1) a. …she put the violin back into back in its case, rather than *toss* it in the fire…
b. Frank *sneezed* the napkin off the table.

(2) a. … time for you to just *lock* them in the basement.
b. … always *keep* your horse at a safe distance from the other horses.

The verb *toss* in (1a) inherently denotes a caused-motion semantics, thus overlapping with the constructional meaning. The verb *sneeze* in (1b), instead, is not even transitive: its co-occurrence with this syntactic pattern which makes the sentence take a caused-motion meaning. The example in (2a) denotes an action whereby a causer participant inhibits a theme participant from leaving a place by imposing a physical barrier. The example in (2b), though, depicts a causer participant's manipulation of a theme participant's behavior to prevent an accident. All these four sentences can be seen as sharing the very general meaning of denoting a change of circumstances in regard to a motion event, but the specific meaning of each of them is fully dependent on the lexical items which they feature (see Broccias 2003).

On the basis of my analysis, I will argue that the notion of 'constructional polysemy' is less than convincing, and that the realizations of the grammatical pattern known as 'caused-motion construction' are better characterized as a continuum of sentences which stand in a relationship of family resemblance, rather than displaying a radial network structure. This claim will be substantiated by the illustration of more examples.

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Auditory-perceptual gestalts assist in the processing of hierarchical structure

Antony Scott Trotter, Padraic Monaghan & Rebecca L. A. Frost

Lancaster University

To accurately process and respond to speech requires rapidly determining the structural dependencies between words in order to comprehend meaning. While phrase structure may be necessary for producing syntactically complex sentences, it has been argued that sequential processing alone may be sufficient for comprehension, with low-level statistical correspondences providing critical support for dependency detection. In the present study, we investigated the extent to which prosody – the rhythmic and melodic aspects of speech – may support low-level processing of long-distance dependencies in complex syntactic structures. We hypothesized that phrasal units that contain syntactic dependencies would be more similar in terms of pitch, enabling grouping according to the gestalt similarity principle. Accordingly, phrases that do not share a dependency will contrast in pitch, resulting in perceptually distinct groupings. Further, we hypothesized that pause duration could reflect the gestalt principle of proximity; where pauses occurring between clauses would render those clauses distinct if they were longer in duration than pauses elsewhere in the speech. Similarly, pauses should be of a shorter duration within clauses, supporting the grouping of words contained in each clause.

To explore this possibility, we analysed behavioural data from Montag and MacDonald (2014). In their study, American English speakers (n = 64) spontaneously produced either passive (e.g. $[\text{the bear}]_1$ $[\text{held}]_2$ $[\text{by the girl}]_3$ $[\text{is green}]_4$) or hierarchical centre embedded sentences (HCEs, e.g. $[\text{the bear}]_1$ $[\text{the girl}]_2$ $[\text{held}]_3$ $[\text{is green}]_4$), elicited using a picture description task. These sentences were divided into four phrase positions (as indicated by the indices in the examples). According to the proximity and similarity principles, we expected shorter pause, and more similar pitch to occur between dependent phrases, distinguishing passive and HCE structures. Linear mixed effects modelling revealed a smaller pitch decrease from the first to second positions in passive sentences (passive; 9.6Hz (t = -6.05) vs. HCE; 12.8Hz (t = -5.93)), and a smaller pitch decrease from second to third positions in HCEs (HCE; 6.4Hz (t = -2.626) vs. passive; 17.9Hz (t = -12.623)). Thus, the data suggest that for HCEs, phrases within the medial clause are more easily grouped on the basis of pitch, contrasting with passives, where pitch similarity was highest between phrases one and two, and, three and four. Analysis of pause duration is currently ongoing. The different pitch progressions enable the similarity gestalt to support syntactic dependencies and deter interpretations consistent with canonical word order in passives, consistent with low-level computations driving syntactic processing. HCEs are known to be challenging to process, but here we see evidence that in speech, pitch similarity provides reliable cues for tracking their dependencies; phrases in the medial clause are voiced similarly, distinguishing the phrases of the main clause, assisting in the detection of long-distance dependencies.

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Coordinating simultaneous comprehension and production: Behavioral and modelling findings from shadowing and simultaneous interpreting

Jeroen van Paridon[1,2], Ardi Roelofs[3] & Antje Meyer[1,3]

1 Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands
2 International Max Planck Research School for Language Sciences, Nijmegen, The Netherlands
3 Centre for Cognition, Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, The Netherlands

Several current theories of speech comprehension and production posit overlap between the comprehension and production systems in the form of shared representations and there is some evidence to support this assumption (e.g., Indefrey & Levelt, 2004; Meyer & Huettig, 2016). The existence of such shared representations would require careful coordination of access to these representations to avoid unwanted interference during tasks that involve temporally overlapping comprehension and production.

To examine this coordination of comprehension and production, we elicited simultaneous comprehension and production in two tasks: English to English speech shadowing and English to Dutch simultaneous interpreting. Twenty adult native speakers of Dutch were screened for English proficiency and familiarized with shadowing and simultaneous interpreting tasks. They then performed both shadowing and simultaneous interpreting tasks with stimuli (short excerpts from books for young readers) presented at speech rates between 100 and 200 words per minute. Their utterances were transcribed and their performance was quantified by computing the proportion of correctly repeated/translated content words. As expected, speech rate was negatively correlated with performance in both tasks, but with increasing speech rate simultaneous interpretation performance deteriorated much more than shadowing performance. A computational model of the speech comprehension and production system was tuned in its parameters to mimic the performance of individual participants in both tasks. Examination of the model parameters and performance suggests that a model with temporally alternating access to shared representations at different levels of a shared linguistic system could better account for the findings than a model with separate comprehension and production systems.

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Disentangling encoding and retrieval interference: evidence from agreement

Sandra Villata (University of Geneva), Whitney Tabor (University of Connecticut), Julie Franck (University of Geneva)

Similarity-based interference in the processing of long-distance dependencies (LDDs) is generally assumed to originate during cue-based retrieval: when the retrieval cue matches multiple items, target retrieval is harder (*retrieval interference*, RI; e.g., McElree 2006). Interference can also arise when items in memory resemble each other in features that are not cued by the verb, which decreases item distinctiveness (*encoding interference*, EI; e.g., Gordon et al. 2001). Importantly, evidence traditionally interpreted as RI is also compatible with EI, since poor encoding negatively impacts retrieval. However, empirical evidence for EI is scarce, data are compatible with alternative explanations (Van Dyke & McElree 2006), and only one paper tries to tease the two apart (Jäger et al. 2015). In fact, although Jäger et al. concluded against EI, their off-line data supported it. Moreover, on-line data were interpreted as evidence for RI although the effect showed faster reading times (RTs) in the condition expected to be harder, i.e., that with higher similarity among elements. To test for the role of EI and disentangle it from RI, we conducted two self-paced reading experiments on Italian and English object relative clauses, manipulating agreement features of the object and the subject (match vs. mismatch) and the presence vs. absence of a retrieval cue on the verb. In Italian, verbs are not marked for gender, so gender is not a retrieval cue (e.g., *The waiter-F/M that the dancer-F/M has* ***surprised-Ø*** *drank a cocktail*). In English, present tense verbs specify number, providing a retrieval cue, but past tense verbs do not (e.g., *The waiter(s)-S/P that the dancer-S strongly* ***criticizes-S/criticized-Ø*** *most of the time ordered a rum*). If interference affects retrieval only, a facilitatory mismatch effect is expected in the English present tense condition only. If interference affects encoding only, a facilitatory mismatch effect is predicted both in Italian and English, and to a similar extent in the two English conditions. If interference affects both retrieval and encoding, a stronger facilitatory mismatch effect is expected in the English present tense than past tense. Each study contained 32 sets of grammatical sentences followed by a comprehension question targeting thematic role attribution. Residual log RTs for correct trials and accuracy proportions were analyzed with (generalized) linear mixed-effects models.

Italian (N=167). Accuracy was higher in the mismatch (M=84%) than in the match condition (M=77%) (p<.001). RTs at the critical past participle region were faster with mismatch (p=.025), but the effect was driven by slow trials. **English (N=130)**. Accuracy rates were marginally higher in mismatch (M=67%) than in match conditions (M=64%) (p=.086), an effect that did not interact with tense. However, RTs revealed an interaction at the spillover region (p=.05): RTs were faster in the mismatch condition in the present tense condition only, the effect again driven by slow trials. **Discussion**. Off-line results from Italian and English provide clear evidence for EI, replicating Jäger et al. in two other languages. The marginal role of RI found in on-line processing, driven by slow trials, is in line with the lack of effect often reported in the literature (e.g., Dillon et al., 2013, Lago et al. 2015; Wagers et al., 2009). We discuss two possible mechanisms that can generate EI. The first extends ACT-R (Lewis & Vasishth 2005) to include *activation levelling*, which equalizes the activation of elements sharing a feature. The second one extends self-organization (Tabor & Hutchins, 2004) to include the slow transfer of agreement features onto the verb representation during online processing.

Viewpoint Specificity in L1 and L2 British Sign Language Comprehension

Freya Watkins, Diar Abdlkarim and Robin L. Thompson
School of Psychology, University of Birmingham, UK

Acquiring a signed language involves learning in a visuospatial modality in which three-dimensional signs are seen and processed from many different visual angles. For L1 and L2 acquisition there are likely differences in the diversity of exposure to such viewpoints. While L1 signers gain input from child-directed signing (which can be e.g. face-to-face or looking up at adults) as well as watching dialogues and group discussions from side angles, L2 learners mostly receive canonical-view input, from a teacher at the front of the class or from 2D resources such as books or online videos. Recent poor performance nationwide on an intermediate-level British Sign Language (BSL) receptive skills exam involving a dialogue [1] suggests serious problems with L2 processing from non-standard viewpoints (the dialogue required comprehension of 2 signers from a side angle).

We hypothesise that differences in frequency and type of exposure to multiple visual angles of the same sign may affect whether phonological representations of signs are viewpoint-specific or easily 'rotatable'. Viewpoint specificity may be analogous to specificity effects for indexical features of spoken language representations, e.g. talker identity change, which has been found to slow spoken word recognition, but not lexical decision [2]. Viewpoint-specific priming has been found in sign/gesture discrimination [3], but does this hold for a task engaging linguistic processing such as semantic decision? Furthermore, are there acquisition effects in how viewpoint change influences comprehension?

In the present study, hearing L1 signers, Deaf L1 signers, fluent hearing L2 signers and intermediate hearing L2 learners perform a semantic decision task (is it edible/living?) in a distance priming paradigm to *n*=240 BSL signs presented from five different viewpoints (Figure 1). Each sign is seen once as prime and once as target (3 conditions: no change, 45° change, 90° change).



Figure 1: Example stimulus ALARM shown from the 5 different viewpoints used: 90°L, 45°L, 0°, 45°R, 90°R

Testing is currently underway. We predict that L2 signers will show faster RTs and better accuracy the smaller the degree of change between prime and target, due to viewpoint-specific representations, whereas L1 signers will show evidence of repetition priming regardless of the change in viewpoint, due to more 'rotatable' viewpoint-independent representations. Overall the findings will have implications for sign L2 learning strategies, e.g. a greater emphasis on dialogue comprehension during teaching.

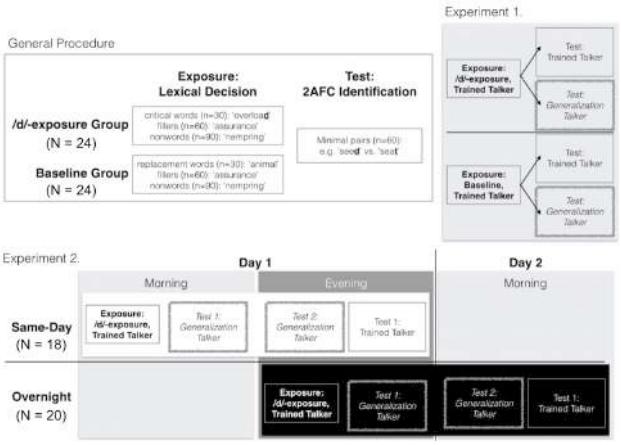
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What happens after adaptation? Memory consolidation effects on the maintenance and generalization of phonetic retuning

Xin Xie[1], F. Sayako Earle[2] & Emily B. Myers[3]
[1]University of Rochester; [2]University of Delaware; [3]University of Connecticut

Speakers differ in the way they talk. Existing evidence show that listeners use lexical knowledge to retune phonetic representations, thereby adapting to the unique phonetic 'fingerprint' of a talker (e.g., a foreign-accented speaker)[1]. However, little is known about the memory representations of learned speech variation over time[2]. In particular, the cognitive mechanisms by which listeners generalize prior individual-based experiences to novel talkers remain poorly understood. One hypothesis[3] is that offline memory consolidation is critical for the development of overlapping representations between long-term stored knowledge and recent experiences. In the present study, we ask whether, after phonetic retuning, listeners benefit from memory consolidation by showing better retention of talker-specific learning and more effective cross-talker generalization.

Methods. Across experiments, Native-English participants were trained with a Mandarin-accented talker and tested on this talker (Trained Talker, TT) and a novel Mandarin talker (Generalization talker, GT; see Fig.1 for design). We examined listeners' perception of word-final alveolar stops (/d/ and /t/) in Mandarin-accented English, where word-final /d/ sounds often sound like /t/s. During training, listeners were familiarized with accented words from TT. At test, listeners categorized minimal pairs of /d/- and /t/-final words, produced either by TT or GT (a between-participants manipulation). Mixed-effect logit models were used in analyses.



Results. Exp.1 compared two groups in a single session: the /d/-exposure Group heard /d/-final words (perceptually /t/-like) while the Baseline Group heard replacement words with no final stops. Perceptual learning was indexed by an increase in /d/ reports for /d/-final words among the /d/-exposure Group than Baseline at test. Exp.1 showed same-session adaptation for TT ($p < .05$) but no significant transfer to the GT ($p = .32$). Exp.2 examined within-participants changes over time across two test sessions. The training phase was identical to that of the /d/-exposure condition in Exp.1. However, participants were trained and tested either in the morning (Same-Day group) or evening (Overnight group), and again after twelve hours. After a delay, both groups showed maintenance of talker-specific learning, with no significant difference ($p = .31$) between the delay groups and the immediate test group (Exp.1). Differences between groups emerged on GT: only Overnight participants, who had slept before Test 2, showed better categorization of /d/ words (Test 2 > Test 1; $p = .05$). In contrast, Same-Day participants did not improve over the 12 hours in wake state (Test 2 < Test 1; $p = .14$; a Group X Test Session interaction was significant, $p = .01$).

We argue that while talker-specific learning is long-lasting, sleep-mediated memory consolidation helps listeners to abstract away from specific acoustic properties of the trained talker and thereby facilitates generalization to the novel accented talker.

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On the effects of animcy and similarity in sentence production in Mandarin Chinese

Yangzi Zhou, Holly Branigan & Martin Pickering

Mandarin has three ways to produce a simple sentence:

a) Canonical (C) active: (Helen) da-le (Johnny) *'(Helen) hit (Johnny)'*
b) *BA*-active (BA): (Helen) *BA* Johnny da-le *'(Helen) hit Johnny'*
c) *BEI*-passive (BEI): (Johnny) *BEI* (Helen) da-le '*Johnny was hit by Helen'*

Bock & Warren (1985) proposed that language production can be affected by entities' *conceptual accessibility*, referring to the ease to retrieve an entity's concept from long-term memory. For instance, animate nouns are more conceptually accessible than inanimate nouns. In addition, *conceptual similarity* between the elements could also constrain language production by causing interference. This is called the role of similarity-based interference (e.g. Gennari, Mirkovic & MacDonald 2012). Very limited studies examined the accessibility and/or the similarity effects in Mandarin. Hsiao, Gao & MacDonald (2014) reported a similarity effect in Mandarin simple sentence production such that more subject omission occurred when the entities were semantically similar than when they were dissimilar. However, these findings were questionable because first, the materials design was biased (inconsistent introductory pictures before the target picture). Second, only patient's animacy, but not agent's animacy was manipulated. Thus, whether subject omission was due to similarity or the animate property of the omitted elements cannot be distinguished. Also, some confounding factors, e.g. similarity, were not controlled well.

The current study investigates the effects of animacy and similarity in Mandarin. Hsiao et al., (2014) and Prat-Sala & Branigan (2000) were adapted by including a larger set of carefully controlled materials. Both agents' and patients' animacy were manipulated, and patient was made salient in the discourse. A picture-description task was conducted. Results showed that agent's animacy was the strongest predictor for the production of C and BEI-structure sentences, as compared to patient's animacy and their interaction, which could significantly predict the production of BEI sentences only. Crucially, a non-significant similarity effect was found, suggesting that speakers did not produce more subject omission sentences when entities were semantically similar than dissimilar ($p=.646$). This is incompatible with Hsiao et al., (2014) and Gennari's (2012) widely-attested role of similarity-based interference. Interestingly, interference was occurred when the two entities were semantically dissimilar. Given that in AI, patient was both animate and salient, to enhance communication efficiency and release memory load, the subject, i.e. the inanimate patient, could be the most easily omitted. The non-significant effect of semantic similarity indicated the effectiveness of the changes in the material design from Hsiao et al., (2012). It could also be explained by the close linear distance between agent and patient in Mandarin.

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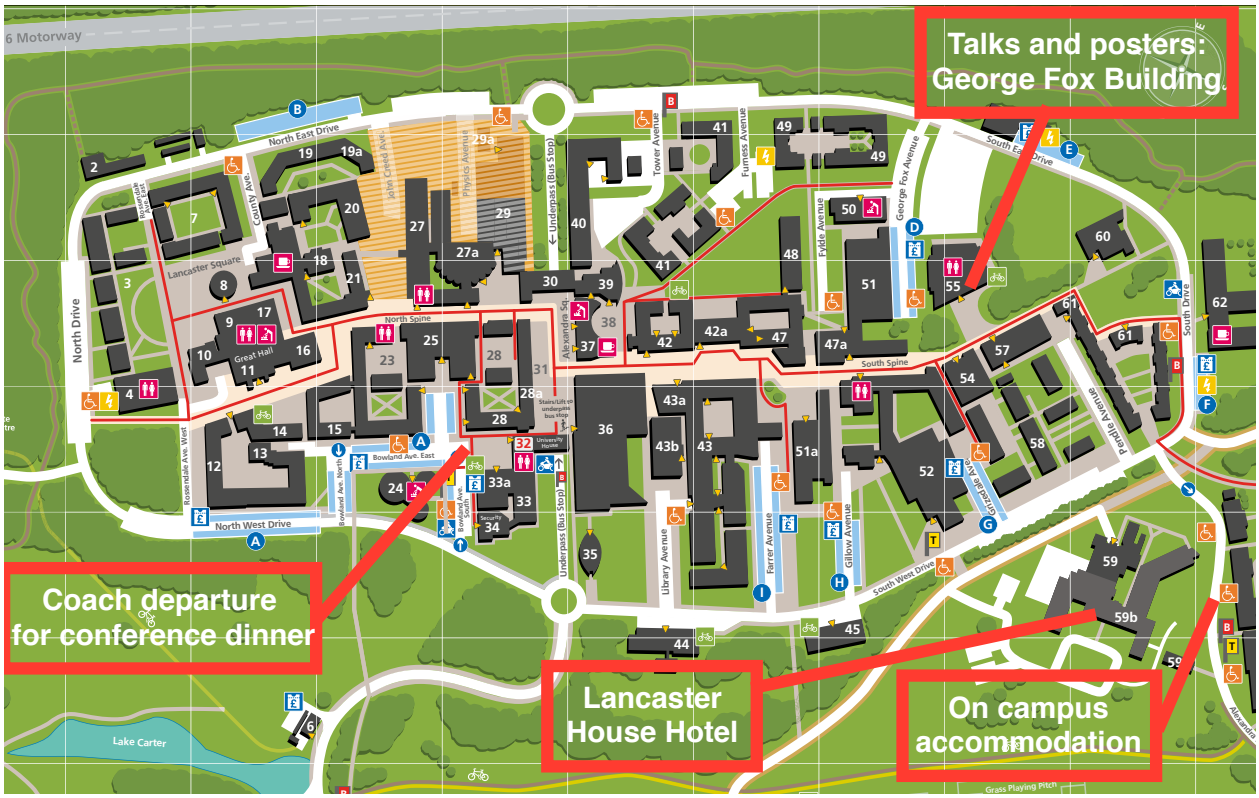
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