International Workshop on Language Production

July 25-27, 2016
La Jolla, California

hosted by the Center for Research in Language at the University of California, San Diego

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Special Session

IWLP 2016 includes a National Science Foundation-supported special session on the State of the Art in Language Production. The aim of this special session is to provide expert perspectives on current issues in language production from five of the most important areas in the field: neuropsychology, cognitive neuroscience, individual differences, computational linguistics, and bilingualism.

Special Session invited speakers include:

Nina Dronkers (VA Northern California Health Care System, USA)
Stefan Th. Gries (University of California, Santa Barbara, USA)
Gerrit Jan Kootstra (Windesheim University of Applied Sciences, the Netherlands)
Antje Meyer (Max Planck Institute for Psycholinguistics, the Netherlands)
Kristof Strijkers (CNRS & Aix-Marseille Université, France)

The special session has been generously funded by the National Science Foundation.

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Monday Program

July 25, 2016

8:00am – 9:00am	Registration with Coffee and Light Breakfast
9:00am – 9:10am	Welcoming Remarks

Session I – Chair: Adam Buchwald, New York University

9:10am – 10:10am	Honey, I shrunk the processor: Taking a processing perspective on children's syntactic production Holly Branigan
10:10am – 10:20am	Questions
10:20am – 11:20am	Spontaneous Error Monitoring and Incremental Lexical Learning Myrna F. Schwartz
11:20am – 11:30am	Questions
11:30am – 11:40am	Discussion

11:40am – 1:00pm	Lunch Break (on your own)
1:00pm – 2:15pm	Poster Session A (Coast Room) and Coffee

Session II – Chair: Matthew Goldrick, Northwestern University

2:15pm – 3:15pm	Scaling the Dark Side Gary Oppenheim
3:15pm – 3:25pm	Questions
3:25pm – 4:25pm	On corpus data in language production research Stefan Th. Gries
4:25pm – 4:35pm	Questions
4:35pm – 4:45pm	Discussion

4:45pm	Adjourn

Tuesday Program
July 26, 2016

8:30am – 9:00am	Coffee and Light Breakfast

Session III – Chair: Alissa Melinger, University of Dundee

9:00am – 10:00am	Utterance planning and resource allocation in dialogue Antje Meyer
10:00am – 10:10am	Questions
10:10am – 11:10am	How bilinguals make linguistic choices: An experience-based perspective Gerrit Jan Kootstra
11:10am – 11:20am	Questions
11:20am – 11:30am	Discussion

11:30am – 12:15pm	Boxed Lunch (provided by workshop)
12:15pm – 1:30pm	Poster Session B (Coast Room) and Coffee

Session IV – Chair: Marina Laganaro, Université de Genève

1:30pm – 2:30pm	A neural assembly based view on word production Kristof Strijkers
2:30pm – 2:40pm	Questions
2:40pm – 3:40pm	Brain Mechanisms of Speech and Language Production Nina Dronkers
3:40pm – 3:50pm	Questions
3:50pm – 4:00pm	Discussion

4:00pm	Adjourn

5:30pm – 8:00pm	Conference Dinner at The Cottage 7702 Fay Ave, La Jolla, CA 92037

Wednesday Program

July 27, 2016

8:30am – 9:00am	Coffee and Light Breakfast

Session V – Chair: F.-Xavier Alario, CNRS & Aix-Marseille Université

9:00am – 10:00am	Memory for Conversation Sarah Brown-Schmidt
10:00am – 10:10am	Questions
10:10am – 11:10am	The role of the body in coordinating minds and utterances in interaction Judith Holler
11:10am – 11:20am	Questions
11:20am – 11:30am	Discussion
11:30am	Adjourn

Poster Session A

Monday, July 25, 2016 ~ 1:00pm – 2:15pm*
*Odd numbered posters to present 1:00pm – 1:45pm
 Even numbered posters to present 1:30pm – 2:15pm

00. **Learning from past miscommunications: Phonetically specific errors by interlocutors lead to phonetically specific hyper-articulation by speakers**
Esteban Buz, Michael Tanenhaus & T. Florian Jaeger

01. **Using tDCS to facilitate learning of non-native consonant clusters**
Adam Buchwald, Mara Steinberg Lowe & Holly Calhoun

02. **Modulations of word planning processes by dual-tasks: an ERP study with different SOAs**
Raphaël Fargier & Marina Laganaro

03. **Parallel Processing in a Language Task: Estimates from Intracerebral Single Trial Data**
A.-S. Dubarry, A. Llorens, A. Trébuchon-Da Fonseca, R. Carron, C. Liégeois-Chauvel, C. Bénar & F.-X Alario

04. **Aging of word frequency, syllable frequency and phonological facilitation effects in Chinese speech production: An ERP Study**
Qingfang Zhang & Qun Yang

05. **An adjustable-resource model of cognitive control in sentence production**
Nazbanou Nozari, Clara Martin, Nicholas McCloskey & Barry Gordon

06. **Executive control in language production by typical and developmentally impaired children**
K. Sikora, A. Roelofs, D. Hermans & H. Knoors

07. **Inhibiting the left inferior frontal gyrus via TMS has a persistent effect on naming same-category pictures**
Denise Y. Harvey, Rachel Wurzman, Priyanka Shah-Basak, Olufunsho Fayesitan, Daniela L. Sacchetti & Roy H. Hamilton

08. **Testing First-Order and Second-Order Constraint Learning in Visual Sequences**
Jill A. Warker & Simon Fischer-Baum

09. **Long-distance anticipatory coarticulation: a psycholinguistic perspective and method**
Melissa A. Redford, Sergei Bogdanov & Eric Vatikiotis-Bateson

10. **Vowel Space: Revisiting Phonological Neighborhood Density**
Ariel M. Cohen-Goldberg, Jessica Mow & Naomi Caselli

11. **Second Language Fluency Impacts Spoken Word Recognition in the Native Language**
Mona Roxana Botezatu

12. **Relating L2 phonological production and perception to L2 vocabulary acquisition**
Kinsey Bice & Judith F. Kroll

13. **Cost-free language switching in bilinguals: Global or lexical control?**
Daniel Kleinman & Tamar H. Gollan

14. **The role of semantic structure is determining the need for non-linear syntactic planning in sentence production**
Jens Roeser, Mark Torrance & Thom Baguley

15. **Syntactic priming in language production: Evidence for separate mechanisms for syntactic structure and verb repetition**
Michael Baumann

16. **Language-specific Biases Affect Priming during Message Planning**
Carol Chun Zheng & Elaine J. Francis

17. **Split intransitivity modulates look-ahead effects in sentence planning**
Shota Momma, L. Robert Slevc & Colin Phillips

18. **Verb-bias and verb-specific competition effects during spoken language production**
Malathi Thothathiri & Sonali Poudel

19. **Prospective and immediate stutter anticipations in reading**
Joana Cholin, Sabrina Heiler, Alexander Whillier, Annett Jorschick & Martin Sommer

20. **Twisting tongues in English and Spanish**
Zenzi M. Griffin, Lisa M. Bedore, J. Gregory Hixon & Elizabeth D. Peña

21. **Production-side noise inference: Comprehenders expect perseverative errors**
Mark Myslín, Jake Prasad & Roger Levy

22. **Syntactic entrainment in aging and aphasia**
Jiyeon Lee, Sonal Kumar, Jessica Dick, Victor Ferreira & Nick Gruberg

23. **Zooming in on interaction between planning and articulation through the lens of disruptions**
Rhonda McClain, Emily Cibelli, Erin Gustafson, Cornelia Moers & Matt Goldrick

24. **Orthographic effects in Mandarin spoken language production**
Qingqing Qu & Markus F. Damian

25. **Tracking the time course of lexical access in orthographic production: An event-related potential study of word frequency effects in written picture naming**
Markus F. Damian, Qingqing Qu & Qingfang Zhang

26. **The relationship between speech production and perception representations in different non-native sound contrasts**
Misaki Kato & Melissa Baese-Berk

27. **A Recurrent Neural Network Model of the Development of Child Productive Vocabulary**
Philip Huebner & Jon A. Willits

28. **Linking Hand to Mouth: The Relationship Between Manual Dexterity and Language Skills in Typically-Developing Children**
Penny M. Pexman & Michele Wellsby

29. **Frequency affects pronoun production**
Sin-Hang Lau

30. **Language produced after encountering different metaphorical frames for illness**
Rose Hendricks, Lera Boroditsky, Zsofia Demjen & Elena Semino

31. **Distributional changes in speech: Speakers target hyper-articulation to avoid highly confusable speech**
T. Florian Jaeger & Esteban Buz

32. **ERP contrast of semantic facilitation vs interference in picture naming**
Gregoire Python & Marina Laganaro

Poster Session B

33. **Distinguishing languages from dialects: A litmus test using the picture-word interference task**
Alissa Melinger

34. **Lesions to the Left Lateral Prefrontal Cortex Impair Decision Threshold adjustment for Lexical Selection**
S. Ries, R. Anders, L. Van Maanen & F.-X. Alario

35. **German verb morphology in overt language production: an ERP study**
T. Marusch, L. Jäger, L.Neiß, I. Wartenburger, L. Nickels & F. Burchert

36. **Delayed versus immediate production: An ERP study of morphological processing**
Kate Stone, Anna Jessen, Harald Clahsen

37. **Testing the role of auditory feedback in repetition reduction**
Cassandra L. Jacobs, Torrey M. J. Loucks, Duane G. Watson & Gary S. Dell

38. **Domain-specific control in language production**
Michael Freund & Nazbanou Nozari

39. **Recruitment of cognitive resources during perspective-taking varies with contextual demands**
Alison M. Trude, Barry Gordon & Nazbanou Nozari

40. **Information structure in bilingual Spanish-English child speech**
Pablo Ceja Del Toro, Jidong Chen & Bhuvana Narasimhan

41. **Response Planning and Execution Dynamics during Form Preparation: New Evidence from Continuous Lip Trajectories**
Peter Krause & Alan H. Kawamoto

42. **Changes in semantic and letter fluency in aging**
Jean K. Gordon & Megan Young

43. **Competition affects voice onset time differently for voiced and voiceless stops**
Noah Nelson & Andrew Wedel

44. **Morphophonological patterns influence past-tense production**
Stacey Rimikis, Adam Buchwald & Michele Miozzo

45. **Second-language lexical knowledge benefits first-language lexical retrieval**
Eve Higby, Seamus Donnelly & Jungmee Yoon

46. **Factors influencing variability in native and non-native speech production**
Melissa M. Baese-Berk, Charlotte Vaughn & Misaki Kato

47. **Language switching costs in picture naming: Evidence from highly proficient Chinese learners of Japanese**
Ying Deng & Chie Nakamura

48. **Language Selection at Multiple Levels: The Time Course of Facilitation and Interference Effects in Cognate Production**
Laura Muscalu & Patricia Smiley

49. **Structural priming across the lifespan**
Jayden Ziegler & Jesse Snedeker

50. **Parallels between Action Priming and Syntactic Priming**
Mark J. Koranda, Federica Bulgarelli, Daniel J. Weiss & Maryellen C. MacDonald

51. **Garden-path sentences: perspectives from a production task**
Ana Besserman & Elsi Kaiser

52. **Attraction from afar: What influences verb number choice in Basque sentence production**
Bojana Ristic, Simona Mancini & Nicola Molinaro

53. **Learning verb structures: Do speakers only learn what they see?**
Danbi Ahn, Daniel Kleinman & Victor S. Ferreira

54. **Competing plans explain agreement errors**
Laurel Brehm & Matt Goldrick

55. **Language recovery in aphasia following implicit structural priming**
Grace Man & Jiyeon Lee

56. **Facilitatory effects of syllabic frequency in aphasic speech production: evidence from patients with phonetic and phonological impairments**
Anna Marczyk & Lorraine Baqué

57. **Language treatment improves online sentence production processes in aphasia: Evidence from eyetracking**
Jennifer E. Mack, Michaela Nerantzini, Matthew Walenski, Min Liao & Cynthia K. Thompson

58. **Pickiness and privilege come at a cost: Syntactic diversity effects in bare-noun picture naming**
Nicholas A. Lester & Fermín Moscoso del Prado Martín

59. **How differences between child-directed spoken and written language may have consequences for early language production**
Jessica L. Montag

60. **Priming Implicit Communication**
Alice Rees & Lewis Bott

61. **Conceptual representations of edited words linger in working memory: Evidence from pronoun production**
Hossein Karimi & Fernanda Ferreira

62. **Measuring articulatory reduction in silent gesture**
Savithry Namboodiripad, Ryan Lepic, Daniel Lenzen & Tessa Verhoef

Speakers

Honey, I shrunk the processor: Taking a processing perspective on children's syntactic production

Holly Branigan

The University of Edinburgh

In the last forty years, language production researchers have made vast strides in understanding the nature of adult processing. An ever-increasing body of naturalistic and experimental evidence of speakers' utterances has been used to develop detailed models of the architecture of the production system that encompass all stages from intention to articulation. Although there is disagreement about the details of such models (e.g., the degree of interactivity between levels), there is broad agreement about many aspects (e.g., the incrementality of processing), and the models make specific predictions that can be used to discriminate and further refine them.

But strikingly, we still know very little about the nature of the processing mechanisms that are involved in children's language production. Naturalistic and experimental evidence from children's utterances is generally interpreted from the perspective of determining the state of their linguistic knowledge at a given point in time, or understanding the learning mechanisms by which they have acquired that knowledge. Researchers may appeal to 'processing limitations' and 'performance constraints' that influence children's utterances, but there has been little systematic attempt to develop detailed processing models of children's language production that would provide a robustly motivated basis for such claims.

In this talk, I'll consider the extent to which adult models of syntactic processing in production might be informative about, and applicable to, children's syntactic production. I'll discuss whether existing evidence supports the assumption of a qualitatively different model of syntactic processing in children's production, or whether it instead suggests at least some continuity of processing between childhood and adulthood that is modulated by quantitative differences in the way in which relevant information can be accessed and brought to bear.

Spontaneous Error Monitoring and Incremental Lexical Learning

Myrna F. Schwartz

Moss Rehabilitation Research Institute

Clinicians have long appreciated that people with aphasia (PWA) who self-monitor their errorful speech have better outcomes. It has been assumed, with empirical justification, that this is because successful monitoring is associated with a stronger language system and a strong system is more likely to improve (*Strength hypothesis*). A second possibility, not incompatible with the first, is that monitoring success in some way causes those language systems to undergo adaptive change (*Learning hypothesis*). This talk reviews recent evidence from PWA that supports both the Strength and Learning hypotheses. We obtained novel evidence that errorful items that were spontaneously self-corrected had a higher probability of being named correctly on a future occasion (forward prediction). The effect was also significant in the backwards direction, which is evidence for the Strength hypothesis. The evidence for learning – restricted to semantic errors – was that self-correction produced bigger change in the forward than backwards direction. In discussion, we present an explanatory framework that integrates aspects of monitoring theory with models of word production and incremental learning. For example, the "dark side" naming model features a supervised learning algorithm that computes the difference between the desired ("correct") activation vector and the actual vector on each trial and adjusts the relevant weights to minimize the difference, strengthening weights to the target and weakening those of competitors. Our working assumption is that the "supervisor" for lexical learning is the central monitor and that the self-monitoring behaviors of PWAs can serve as indicators of whether the learning system, via the central monitor, has the information it needs about which weights to weaken (those associated with a detected error) and which to strengthen (those of the recomputed (repaired) response). Our evidence to date is that the feedback associated with error repair is a necessary driver of learning.

Monday, 2:15 PM

Scaling the Dark Side

Gary Oppenheim

Bangor University

With over 40,000 options to choose from, finding a single word in less than a second should be an incredibly difficult task. Yet we do it, effortlessly, 16,000 times each day. A key to this success is that we continually re-optimize our vocabularies throughout our lives, adapting to challenges in the recent past so that the words we need tend to be most accessible when we need them. I'll first introduce a simple model of word retrieval that embodies this idea by learning as it produces each word, thus explaining a set of behavioral phenomena as manifestations of an implicit learning-based cumulative semantic interference. I'll then provide new evidence that this learning is implicit, cumulative, long-lasting, and occurs in even in the most normal of contexts. Finally, I will show that this simple model scales-up gracefully to incorporate realistically sized vocabularies with realistic semantic representations, and that doing so naturally resolves two types of apparent inconsistencies within its domain: those where the model's predictions seemed to diverge from empirical results, and those where empirical results have varied for apparently equivalent experiment designs.

Monday, 3:25 PM

On corpus data in language production research

Stefan Th. Gries

University of California, Santa Barbara

In this talk, I will survey corpus linguistic approaches to selected aspects of language production. In particular, I will use examples from the study of syntactic alternations to discuss corpus-linguistic and quantitative desiderata regarding psycholinguistic research of language production. With regard to the former, I will touch upon corpus-linguistic ways to approximate notions such as frequency, contingency, recency on the basis of association measures, dispersion, priming/persistence, etc.; with regard to the latter, I will discuss important aspects of statistical modeling such as the hierarchical structure of many kinds of corpus data, different random effects, and alternatives to the currently state-of-the-art of regression modeling. I will discuss case studies concerned with L1 and L2/FL phenomena based on a variety of different kinds of corpus data with an eye to exemplify various best practices for the corpus-based analysis of language production.

Speakers

Utterance planning and resource allocation in dialogue

Antje S. Meyer

Max Planck Institute for Psycholinguistics

Natural conversations are characterized by smooth transitions of turns between interlocutors. For instance, speakers often respond to questions or requests within half a second. As planning the first word of an utterance can easily take a second or more, this suggests that utterance planning often overlaps with listening to the preceding speaker's utterance. A specific proposal concerning the temporal coordination of listening and speech planning has recently been made by Levinson and Torreira (2016, Frontiers in Psychology; Levinson, 2016, Trends in Cognitive Sciences). They propose that speakers initiate their speech planning as soon as they have understood the speech act and gist of the preceding utterance.

However, direct evidence for simultaneous listening and speech planning is scarce. I will first review studies demonstrating that both comprehending spoken utterances and planning them require processing capacity and that these processes can substantially interfere with each other. These data suggest that concurrent speech planning and listening should be cognitively quite challenging. In the second part of the talk I will turn to studies examining directly when utterance planning in dialogue begins. These studies indicate that (regrettably) there are probably no hard-and-fast rules for the temporal coordination of listening and speech planning. I will argue that (regrettably again) we need models that are far more complex than Levinson and Torreira's proposal to understand how listening and speech planning are coordinated in conversation.

How bilinguals make linguistic choices: An experience-based perspective

Gerrit Jan Kootstra

Windesheim University of Applied Sciences

When a person wants to produce an utterance, (s)he has a number of options. These options pertain to, for example, the words to be used (*couch* or *sofa*?) or the syntactic construction (*the boy gives the ball to the girl* or *the boy gives the girl the ball*). When a person is bilingual, (s)he has an additional option: which language (or languages) to use? These multiple options lead to flexibility of linguistic choices in bilingual speakers, as for example reflected in code-switching (i.e., the use of multiple language in the same utterance) and cross-language priming of syntactic choices. In this talk, I would like to show how this flexibility of linguistic choices in bilingual speakers is influenced by multiple sources of 'experience': 'prior' linguistic experience, such as a bilingual's experience with both languages in daily life, but also by 'recent' linguistic experience, such as interactive alignment in dialogue and structural priming across languages. I will present mostly experimental but also corpus-based research on how these different sources of linguistic experience influence bilingual language use in settings that resemble elements of real-life discourse. I will focus on (1) direct and cumulative effects of cross-language structural priming on Dutch-English bilinguals' syntactic choices, (2) cross-language structural priming as a potential mechanism of contact-induced language change in Papiamentu-Dutch bilinguals, and (3) priming / interactive alignment as a mechanism of linguistic choices in code-switching. In terms of theory, I will focus on the interactivity and context-sensitivity of bilingual language production (both short-term and long-term), as well as on the potential of combining usage-based and psycholinguistic perspectives. In terms of methodology, I will emphasize the importance of combining internal validity with ecological validity.

Tuesday, 1:30 PM

A neural assembly based view on word production

Kristof Strijkers

CNRS – AMU

I will propose a tentative framework of the representational and dynamical properties of word production based on neural assembly theory. According to this view, neurons firing synchronously in response to a particular mental event are bound into large-scale distributed functional units (assemblies) representing that mental event as a whole ('gestalt'). Extrapolating this neurobiological principle to language, the cerebral fingerprint of a word is thought to be engendered by inter-areal cell assemblies in which the different linguistic constituents of a word (e.g., semantic, lexical, phonological and articulatory properties) are grouped together in action, perception and integrating/relaying brain systems, and become activated in parallel. Based on the advances in systems neuroscience, I will discuss the advantages of assembly coding over the traditional hierarchical convergence scheme underpinning most sequential hierarchical models of language production. Recent EEG and MEG evidence from language production supporting the notion of neural assemblies representing words is discussed and a spatiotemporal model for word production based on this concept is presented. Finally, using bilingual word production as a test case, I will show the power of such model to mechanistically explain some key phenomena in the literature. In this manner, the objective of the talk is to make the link between processing at the cognitive and the neural levels explicit, and generate empirically testable hypotheses of brain-language integration.

Tuesday, 2:40 PM

Brain Mechanisms of Speech and Language Production

Nina Dronkers

VA Northern California Health Care System

Textbook descriptions of language production focus on the role of Broca's area in a range of functions ranging from syntax to articulatory control. In this talk, I will discuss findings that view Broca's area in a different perspective. In particular, the inclusion of other brain structures that support language production in unique ways will be discussed, including the role of fiber pathways that have not previously been implicated. Finally, revisiting the brains of Paul Broca's first patients -- that have been preserved since 1861 -- will shed light on the neuroanatomical structures involved in speech and language production.

Speakers

Memory for Conversation

Sarah Brown-Schmidt

Vanderbilt University

In conversation, referential form is influenced by the immediate (local) context, which may include entities in the physical environment as well as recently mentioned information. The discourse history, including past referents and how they were described, also plays a role in shaping future referential form. While it is widely known that interlocutors form representations of the discourse history, the veracity and similarity of these representations between interlocutors has not been widely explored. Through the study of referential form in dialogue, combined with explicit measures of recognition memory for past referents, I show that interlocutors are likely to walk away from a conversation with distinct memories for the contents, and in some cases the context of conversation. In general, speakers tend to remember what was said better than listeners do. These findings have implications for how common ground is formed in conversation, and suggest that there are limits on the degree to which interlocutors can achieve coordinated representations of the discourse history. More generally, this work demonstrates that memory assessments can complement language measures in revealing the means by which conversational partners encode and track common ground in conversation.

The role of the body in coordinating minds and utterances in interaction

Judith Holler

Max Planck Institute for Psycholinguistics

Human language has long been considered a unimodal activity, with the body being considered a mere vehicle for expressing acoustic linguistic meaning. But theories of language evolution point towards a close link between vocal and visual communication early on in history, pinpointing gesture as the origin of human language. Some consider this link between gesture and communicative vocalisations as having been temporary, with conventionalized linguistic code eventually replacing early bodily signaling. Others argue for this link being permanent, positing that even fully-fledged human language is a multi-modal phenomenon, with visual signals forming integral components of utterances in face-to-face conversation. My research provides evidence for the latter. Based on this research, I will provide insights into some of the factors and principles governing multi-modal language use in adult interaction. My talk consists of three parts: First, I will present empirical findings showing that movements we produce with our body are indeed integral to spoken language and closely linked to communicative intentions underlying speaking. Second, I will show that bodily signals, first and foremost manual gestures, play an active role in the coordination of meaning during face-to-face interaction, including fundamental processes like the grounding of referential utterances. Third, I will present recent findings on the role of bodily communicative acts in the psycholinguistically challenging context of turn-taking during conversation. Together, the data I present form the basis of a framework aiming to capture multi-modal language use and processing situated in face-to-face interaction, the environment in which language first emerged, is acquired and used most.

Poster Session A

(00)

Learning from past miscommunications: Phonetically specific errors by interlocutors lead to phonetically specific hyper-articulation by speakers

Esteban Buz, Michael Tanenhaus, and T. Florian Jaeger

University of Rochester

Some studies suggest that speakers adapt their speech in ways that are seemingly to maintaining robust communication. Here we investigate how speakers might learn to adapt. We work with a previously found adaptation wherein speakers hyper-articulate the voice onset timing (VOT) of word-initial voiceless plosives in target words (e.g. 'pill') spoken to a conversational partner in contexts where the targets's voiced minimal-pair is a relevant alternative (e.g. 'bill'; cf. Baese-Berk & Goldrick, 2009; Kirov & Wilson, 2012).

This type of context-based hyper-articulation is enhanced following miscommunication, relative to successful communication (Buz, Tanenhaus, & Jaeger, 2016). This suggests that speakers dynamically adjust hyper-articulation based on perceived communicative success, and therefore that such hyper-articulation occurs partly for communicative reasons. Here we investigate whether adaptation of hyper-articulation is sensitive to the type of miscommunication that has previously occurred. Does being misunderstood lead to across-the-board hyper-articulation or do speakers hyper-articulate primarily aspects of their speech that likely caused the previous miscommunication?

We employ the same paradigm as Buz et al. (2016). Between participants we manipulated the type of miscommunication. In the No Errors condition, participants never experienced miscommunication. In the Filler Errors condition, participants experienced miscommunications that were not voicing related (the target word was misunderstood as a phonetically unrelated alternative). In the Voicing Errors condition, participants experienced miscommunications that were voicing related (the target was misunderstood as its voiced minimal-pair; e.g. misunderstanding 'pill' as 'bill'). We find that targets' VOTs were hyper-articulated when their voiced minimal-pairs were present, replicating previous findings. This context-based hyper-articulation did not differ between the No and Filler Error conditions. Critically, hyper-articulation was greater in the Voicing Error condition compared to the other two conditions. The findings suggest that speakers can dynamically adapt hyper-articulation of specifically those features that they take to have caused previous miscommunication.

(01)

Using tDCS to facilitate learning of non-native consonant clusters

Adam Buchwald, Mara Steinberg Lowe, and Holly Calhoun

New York University

In the domain of spoken production, consonant cluster production has been of particular interest because of their difficulty in acquisition and language loss following stroke, as well as in non-native cluster production. In this paper, we report on a study designed to test whether non-invasive neuromodulation from transcranial direct current stimulation (tDCS) can enhance learning of consonant clusters in unimpaired speakers. We use a behavioral approach that builds on the literature on motor learning discovered in other domains, and has been successful in being applied to speech motor learning (Maas et al., 2008). In limb motor control, evidence suggests that motor learning may be enhanced from combining behavioral learning with the safe and well-tolerated low current noninvasive neuromodulation provided by tDCS. Within the speech and language domain, tDCS has been studied as a tool to facilitate language production in aphasia and unimpaired speakers (Monti et al., 2013), but has not previously been used to facilitate sound structure production.

Here, we report our initial findings that suggest that using tDCS as an adjunct to a speech motor learning protocol can facilitate learning of nonnative consonant clusters. Participants performed a speech motor learning task in conjunction with either active or sham stimulation. During practice, participants were asked to produce nonwords with nonnative consonant clusters (e.g., /ftimu/; /pkuti/) and were then tested during two retention sessions (same day and 2 days later) on the trained nonwords and on untrained nonwords with the same consonant clusters. While all participants (N=22 at present) improved following the training protocol, participants receiving active tDCS have shown greater improvement. These preliminary findings suggest a promising route for facilitating cluster production and suggest that learning to produce novel sound structure sequences may rely on similar neurocognitive mechanisms to other forms of motor learning.

(02)
Modulations of word planning processes by dual-tasks: an ERP study with different SOAs

Raphaël Fargier and Marina Laganaro

University of Geneva, Geneva

Increased attentional demand has a detrimental effect on speech production. However, little is known on the degree of attentional demand of the encoding stages. Recently we showed1 that non-verbal and verbal concurrent stimuli (tones or syllables) influenced lexical processes. However, only syllables interfered with post-lexical processes suggesting that attentional demand of phonological-phonetic processes relies on the degree of shared processes and neural networks between tasks.

Here, we manipulated stimulus onset asynchronies (SOAs) of the concurrent verbal stimuli. Event-Related Potentials (ERPs) were recorded during picture naming (PN), PN with passive listening to syllables and PN during a syllable detection task.

Auditory syllables appeared either 150 ms after picture onset (SOA=+150ms), 300 ms (SOA=+300ms) or 450 ms afterwards (SOA=+450ms), which is assumed to tap into different encoding stages2; respectively pre-lexical, lexical or phonological processes.

In the passive task, participants named the pictures while ignoring the distractors. In the active task, we used a go/no go paradigm and asked participants to detect only one specified syllable while continuing to name all pictures.

We observed increased production latencies in the active task (Mean150 = 840ms; Mean300 = 840ms; Mean450 = 850ms) compared to picture naming only (Meanno = 780 ms) but no difference as a function of SOAs. In the passive task, increased production latencies were gradual and maximal at SOA = +450ms (Mean150 = 813ms; Mean300 = 831ms; Mean450 = 865ms).

These behavioral results suggest that in the active task participants attend to the syllables they have to detect, which interferes with word production no matter which planning phase is engaged in when the distractor is presented.

The results obtained for the passive task are more informative: while distractors minimally affect early word planning processes (e.g. lexical selection) interference was larger when concurrent verbal stimuli appeared afterwards (SOA=+450ms), suggesting that word-form encoding is more sensitive to dual-task interference. We are currently conducting the ERPs analyses to confirm these hypotheses.

(03)
Parallel Processing in a Language Task: Estimates from Intracerebral Single Trial Data

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Cognitive theories describing information processing stages are often concerned with their temporal organization. A primary distinction has been made between serial and parallel architectures, that is between stages that operate sequentially and stages that operate concurrently. This distinction has been extensively explored with behavioral and, more recently, neurophysiological evidence, notably in models of language processing. Yet, despite the available evidence, the issue often remains unsettled. Here, we provide a critical examination of the cognitive distinction between serial and parallel processing, and discuss the methodological conditions that need to be met to asses such alternative. The importance of reasoning at the level of single trials, rather than averages, is highlighted. We then report the results of an experiment where the parallel processing hypothesis was tested at an unprecedented level of granularity with intracerebral data recorded during a picture naming task. We extracted patterns of significant high gamma activity, a trusted index of cognitive processing. Data from multiple patients were combined into a single analysis framework that identified consistent patterns. Signals recorded within different brain regions, presumably indexing distinct cognitive processes, revealed a large degree of concurrent activity when they were averaged. In comparison, the temporal overlap detected among significant activities at the level of single trials was unexpectedly low, with the exception of visual and motor cortices. These findings show the limitations of using on average measures to test temporal processinghypothesis. They reveal remarkable limits on how much parallel processing is detected during a multi-stage task such as picture naming.

(04)

Aging of word frequency, syllable frequency and phonological facilitation effects in Chinese speech production: An ERP Study

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Effects of word frequency (WF) and syllable frequency (SF), and phonological relatedness in picture naming have been investigated in speech production. The present study aims to investigate the aging of speech production via comparing these effects between the young and the old speakers. In a picture-word interference task, we used the event-related potential (ERP) technique to examine the time course of the WF facilitation effect, the SF facilitation effect, and the phonological facilitation effect during speech production in Chinese. The participants were required to name pictures while ignoring distractors. The facilitation effects of the WF and the SF were observed in the young and the old, and the WF and the SF facilitation effects were larger in the old than in the young. The young yielded a larger phonological facilitation effect than the old, reflecting that the young could benefit more than the old in the phonologically related condition. The interaction between the WF and the SF were observed in the old but none in the young. For the young, the WF effect in the time window of 150-250 ms, the SF effect in the time window of 250-350 ms, and the interaction between the WF and the SF in the time window of 100-150 ms were found. For the old speakers, an interaction between the SF and the WF in the time windows of 150-250 ms, 350-400 ms and 400-500 ms were found. Our findings indicate that the WF effect arose in the time window of lexical selection and the SF effect arose in the time window of phonological encoding in the young, but these two effects arose later in the old, indicating that all processing stages of speech production were slowed down in the old. The results will be discussed in the poster.

(05)

An adjustable-resource model of cognitive control in sentence production

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How are cognitive control resources applied to sentence production? We investigated this by examining the pattern of errors and corrections on the same words when they appeared earlier in the sentence (NP1) or later (NP2), as balanced-bilinguals described visual events such as "The blue suitcase disappears behind the brown window" in blocks of English and Spanish. We found that, in both languages, error-rates increased significantly from NP1 to NP2, but interestingly, correction proportions also increased reliably from NP1 to NP2. While higher error rates on NP2 are compatible with a simple resource model which assumes that control is a fixed-capacity resource that is gradually depleted as interference builds up, the parallel increase in error correction is not. Additionally, within each of NP1 and NP2, the first element (adjective in English and Noun in Spanish) was associated with greater error rates and greater correction rates and was followed by significantly lower rates on the second element of the NP. Together, these results support an adjustable-resource model of cognitive control, where increased demand for resources, either due to insufficient pre-planning or built-up interference, leads to more errors but also recruits additional resources for correction and prevention of errors on the following word.

(06)
Executive control in language production by typical and developmentally impaired children

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Accumulating evidence suggests that executive control impacts on language production in adults. Moreover, impaired executive control is related to language comprehension problems in children with specific language impairment (SLI). However, little is known about how executive control impacts on language production in typical and developmentally impaired children. In this study, we tested children with SLI and typically developing (TD) children (age 8-11 years) on noun-phrase production using picture description and a picture-word interference paradigm. We measured their production accuracy and speed to assess distractor, length, and switch effects, which reflect the inhibiting, updating, and shifting abilities underlying executive control (Sikora et al., 2016). Moreover, for each child, we obtained scores on executive controltasks that measure the updating, inhibiting, and shifting ability. We found that the SLI children performed worse on all executive control tasks than the TD children. Moreover, the SLI children were overall slower and made more errors in the noun-phrase production task. The magnitude of the distractor effect was larger for the SLI than the TD children, whereas the groups did not differ with respect to the length and switch effects. The magnitude of the length effect correlated with the updating scores for both groups, and the distractor effect correlated with the inhibiting scores of the SLI children only. Taken together, these results suggest that children with SLI have impaired language production and executive controlabilities, but only the inhibiting ability differentially impacts on language production between groups.

(07)
Inhibiting the left inferior frontal gyrus via TMS has a persistent effect on naming same-category pictures

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Naming pictures in the context of semantically related vs. unrelated pictures negatively affects performance. This "semantic interference" is thought to arise due to competition from co-activated, related representations. It is hypothesized that the left inferior frontal gyrus (LIFG) is crucial for resolving lexical competition, as patients with damage to this region show exaggerated semantic interference on tasks that promote lexical competition. However, the mechanism by which the LIFG resolves competition remains unclear. Here, we used inhibitory TMS to elucidate the LIFG's role in resolving lexical competition in the blocked-cyclic naming task. This task promotes competition by requiring subjects to repeatedly name pictures in semantically related (e.g., DOG, CAT, PIG) vs. unrelated contexts (e.g., DOG, VAN, PEAR). Items first appeared in either a related or unrelated context, and were presented again in the other context. We examined whether TMS to the LIFG vs. a control site (i.e., the vertex) differentially affected naming latencies in each context (related vs. unrelated), and as a function of the context with which items first appeared. We found that for related contexts LIFG vs. vertex stimulation increased naming latencies regardless of which context an item appeared in first. However, when naming in the unrelated context, items that were named first in the related context had longer latencies after TMS to LIFG vs. vertex, whereas there was no difference in naming latencies between the two sites when items were presented first in the unrelated context. This suggests that disrupting the LIFG via TMS allowed interference to persist from those items first named in a related context to their second presentation in an unrelated context. Together, these results indicate that the LIFG serves to resolve competition by exerting long-lasting inhibition of competitor words.

(08)

Testing First-Order and Second-Order Constraint Learning in Visual Sequences

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Phonotactics constrain what sounds can occur together in languages. Adults can learn new phonotactic constraints from experience hearing or producing them. In production, this learning is reflected in speech errors. However, how quickly evidence of learning appears in errors depends on the type of constraint. First-order constraints (e.g., /f/ is an onset) are learned rapidly whereas second-order constraints (e.g., /f/ is an onset if the vowel is /æ/) take longer to learn and may require a consolidation period. We investigated whether the mechanisms responsible for constraint learning in production extend to constraint learning in non-linguistic stimuli using an immediate serial recall task. Participants saw sequences of six shapes where particular shapes were restricted to particular structural positions and then recalled the order the shapes appeared. Memory errors were used as a measure of learning. In Experiment 1, a first-order constraint was embedded in the sequences. Participants' memory errors reflected the constraints on shape position, which suggests that the first-order constraint was learned. In Experiment 2, a second-order constraint was embedded in the sequences. Since previous research indicates a consolidation period may be needed, participants completed two sessions of the task, 24 hours apart. Participants' memory errors did not reflect the constraints on the first or second day of testing. This suggests that the second-order constraint was not learned. These results imply that there may be differences in learning constraints in linguistic and non-linguistic stimuli. The mechanisms responsible for phonotactic learning in production may be domain-general for first-order constraint learning but not for second-order constraint learning.

(09)

Long-distance anticipatory coarticulation: a psycholinguistic perspective and method

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Accurate temporal measures of long-distance anticipatory coarticulation permit us to test different predictions regarding the identity of production units. The present study was undertaken to demonstrate this and to validate a psycholinguistic method for studying coarticulation. Five speakers were audio-video (AV) recorded while producing minimal pair sentences with determiner-noun sequences in sentence-final position, where nouns had rounded or unrounded rhymes (e.g., "soup" vs. "sack"). Metrical context for the determiner ("the") was varied using a phrasal verb ("packs up") or plain verb ("packs"). Once recorded, sentences were isolated and gated based on acoustic landmarks from the midpoint of the verb to the end of the sentence. Perceivers decided whether sentences ended in nouns with rounded or unrounded rhymes based on the gated stimuli. The following theory-derived hypotheses were tested: a metrical hypothesis, which predicts that rounding should be evident at the onset of "the" in sentences with phrasal verbs, but not in sentences where the verb-determiner sequence forms a trochee; a meaning-based chunking hypothesis, which predicts that anticipatory lip rounding should align with syntactic structure, thus with the onset of the determiner regardless of metrical context; a dynamical systems hypothesis, which predicts sensitivity to phonetic context, thus that the onset of rounding should be evident earlier in the plain verb case than in the phrasal verb case due to the bilabial offset in the phrasal verb. The results best supported the chunking hypothesis. There were main effects of metrical context and test gate on the correct identification of rounding, but no interaction between the factors. Correct identification of rounding was observed at the onset of "the" in the AV condition, and during schwa in a control audio-only condition. Early correct identification of rounding in the AV condition suggests that the method provides a sensitive measure of anticipatory coarticulation.

(10)
Vowel Space: Revisiting Phonological Neighborhood Density

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The role that phonological neighbors play in spoken production has recently been the subject of considerable attention and reevaluation. Previously reported effects of neighborhood density have been called into question (vowel space expansion, Munson & Solomon, 2004; Gahl, Yao & Johnson, 2012; reaction time facilitation, Vitevitch 2002; Sadat, Martin, Costa, & Alario, 2014) as has the standard 1-segment-difference definition of a neighbor (Caselli, Caselli, & Cohen-Goldberg, 2015; Fricke, Baese-Berk, & Goldrick, 2016). In the present study, we examined whether task differences could underlie the contradictory vowelspace findings. In particular, Munson and Solomon (2004) used a reading task while Gahl and colleagues analyzed a corpus of spontaneous speech; it is well-known that these tasks involve considerably different cognitive computations.

The experiment was a conceptual replication of Munson and Solomon (2004), orthogonally manipulating lexical frequency and whole-word phonological neighborhood density. All of the stimuli were pictureable, allowing us to administer each item in both picture naming and oral reading. We found that lexical frequency and whole-word neighborhood density both led to contractedvowel spaces, replicating the findings of Gahl et al. (2012). No effect of task was found, ruling it out as a confound.

In post-hoc analyses, we explored whether the position of target-neighbor overlap (Caselli et al. 2015; Fricke et al., 2016) affected the direction of the neighborhood density effect. We found that onset-divergent neighbors (map~tap) led to vowel spacecontraction while vowel-divergent (map~mop) and coda-divergent (map~mat) neighbors led to vowel space expansion. Again, no differences were found across task. We propose that vowel space contraction and expansion are indicative of easier and more difficult processing, respectively. We interpret these results within an architecture where 1) onset segments are activated before rhyme segments (Meyer, 1991) and 2) less activated neighbors facilitate target processing while more activated neighbors inhibit target processing (Chen & Mirman, 2012).

(11)
Second Language Fluency Impacts Spoken Word Recognition in the Native Language

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University of Missouri

The study evaluated the impact of production fluency in a second language (L2-Spanish) on spoken word recognition in the first language (L1-English) in learners who have not been immersed in an L2-speaking environment. English learners of Spanish (N=24) who varied on multiple indices of Spanish fluency and English monolingual controls (N=19) performed a spoken-to-written word matching task which asked them to identify spoken English words in noise. Words were presented in 62 dB of white noise and varied in phonological neighborhood density: high-density words (e.g., BAG) and low-density words (e.g., FOG). Participants exhibited the standard inhibitory effect of phonological neighborhood density: faster responses to words from low-density than high-density phonological neighborhoods (Estimate = 61.38, SE =28.12, p =0.029). This inhibitory effect was larger in English learners of Spanish ($\chi2(1)$ = 4.23, p = 0.039; Estimate = -23.55 SE =11.41, p =0.039), who were also overall slower to identify English words spoken in noise relative to their monolingual counterparts (Estimate = -141.2, SE =29.96, p =0.000002). Critically, the magnitude of the inhibitory effect within the learner group was modulated by L2-Spanish fluency, such that a larger neighborhood density effect was observed in learners with lower Spanish fluency levels ($\chi2(1)$ = 4.73, p = 0.029; Estimate = -39.44, SE =18.07, p =0.029), who were also overall slower to respond than learners with higher Spanish fluency (Estimate = -91.34, SE =41.28, p =0.027). Results are consistent with studies suggesting that the native language is more susceptible to the L2 influence in the early stages of L2 learning (e.g., Chang, 2012; 2013; Tice & Woodley, 2012; Botezatu, Misra & Kroll, in preparation) and provide converging evidence with data from aphasia, which associate lower production fluency with a larger inhibitory effect of phonological neighbors on spoken word recognition (Botezatu & Mirman, under revision).

Poster Session A

(12)

Relating L2 phonological production and perception to L2 vocabulary acquisition

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Pronunciation in a second language (L2) is notoriously difficult for adult learners to master, even following many years of immersion in the L2 (e.g., Flege, Munro, & MacKay, 1995). The relation between perception and production is fundamental for understanding the progression of L2 pronunciation, particularly in languages with phonological systems that differ from the native language (L1). Perception is tuned at a very young age to phonological distinctions in the L1, whereas infants exposed to more than one language remain sensitive to cross-language distinctions for longer and are more open (e.g., Werker, Byers-Heinlein, & Fennell, 2016). These early processes lay the foundation for learning at higher levels of language processing (e.g., see Finn et al., 2013). The present study examines how the trajectory of production in a novel language is related to lexical learning, and whether improvements in pronunciation predict performance on a lexical decision task in which non-native phonological contrasts distinguish words from nonwords. Bilingual and monolingual participants learned new vocabulary in Finnish, a language that adheres to vowel harmony, whereby front and back vowels cannot co-occur within a word. Front and back vowels form a distinction that is non-native in English (L1 for both groups) and Spanish (L2 of the bilinguals), making the ability to perceive this contrast difficult. Participants were given an orthographic, pictorial, and auditory presentation of the Finnish words and were asked to pronounce them by mimicking the native speaker's pronunciation. The analysis of the data is ongoing, but the logic is to rate the tokens produced and the trajectory of improvements over 6 blocks of training to determine how well changes in production predict performance on perception in the lexical decision task at the immediate post-test. Results will be discussed as they relate to theories of motor learning and individual differences in language acquisition.

(13)

Cost-free language switching in bilinguals: Global or lexical control?

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Bilinguals often switch languages spontaneously even though experimental studies consistently reveal robust switch costs. These switch costs are driven by top-down control mechanisms, which adjust the relative accessibility of languages to ensure that the target language is spoken. We investigated whether bilinguals can suspend top-down control to allow lexical accessibility to drive language selection, revealing cost-free switches.

Across two experiments, 171 Spanish-English bilinguals repeatedly named a set of 9 pictures. In a "bottom-up block", they were told to use whichever language seemed easiest for each picture at first presentation, but then to use that same language every time that picture appeared. Bilinguals also completed a separate blocks of cued language switching and two blocks of single-language trials for comparison.

In the bottom-up block, bilinguals switched languages more often, named pictures faster, and showed significantly smaller (7 ms, non-significant) switch costs than in the cued block (where switch costs were 49 ms). Furthermore, bilinguals who completed the bottom-up block before the cued block became just as fast overall in the bottom-up block as in the single-language blocks.

Where do these block order effects come from? One possibility is that cued switching tasks engage global control mechanisms that persist during a subsequent task (here, bottom-up switching), making performance less efficient. Alternatively, control mechanisms may be re-engaged only for certain items (which repeated between blocks). A third, in-progress experiment manipulates both block order and stimulus repetition -- whether items are repeated between blocks -- to determine if cued switching engages control mechanisms globally or locally (or both).

Together, these experiments shed light on the nature of global vs. local language control in bilinguals and show that it is possible for bilinguals to mix and switch between two languages as efficiently as they can speak a single language, provided that they switch based on lexical accessibility.

(14)

The role of semantic structure is determining the need for non-linear syntactic planning in sentence production

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Nottingham Trent University

Planning in the production of short sentences is typically not complete at speech onset (e.g., Martin et al., 2010) and typically unfolds linearly (Ferreira and Slevc, 2007). Lee et al. (2013) explored the possibility of non-linear syntactic planning by eliciting utterances of the form "NP PP RC" (e.g., 'the fork of the king that is below the apple'). They found longer onset latencies for the RC modifying the NP compared to the RC modifying the PP noun and argued that high-attaching NP-modifications necessitate non-linear syntactic planning. Conversely, in low-attaching PP-modifications planning can unfold linearly, because incremental planning allows some processing to be delayed until after production onset. We argue that in order to permit more rapid production onset, linear syntactic processing must be established by a pre-syntactic operation.

Although Lee et al.'s manipulation is syntactically encoded, the contrast is semantic. We therefore examined whether, independently of syntactic structure, semantic structure determines whether or not sentence planning is non-linear. In two image-description experiments (Ns=32) we manipulated the semantic scope of the determiner in elicited sentences. In "DET N1 N2" structures DET scoped either over just N1 (narrow) or over both N1 and N2 (wide). For example, in 'the boy's truck is blue' a narrow scope refers to the boy's blue truck as opposed to a comparator's truck with a different colour, while a wide scope refers to a different possession of the boy with a different colour. Evidence from eye movements on the stimulus array prior to output and from longer initial latencies indicated more planning effort dedicated to N2 in the wide scope condition. This effect replicated for NPs with different types of modification (possessives, RCs, PPs). We conclude that semantic structure can determine the scope of syntactic planning prior to production onset even when syntactic structure is held constant.

(15)

Syntactic priming in language production: Evidence for separate mechanisms for syntactic structure and verb repetition

Michael Baumann

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Models of syntactic priming differ in assuming either only one (Pickering & Branigan, 1998; Malhotra et al., 2008; Jaeger & Snider, 2013; Segaert et al., 2014) or separate mechanisms (Reitter et al., 2011; Chang et al., 2015) underlying the persistence of abstract syntactic structure and the effect tied to the repetition of verbs (lexical boost).

Categorical priming, e.g. of the dative alternation (DA), is a well attested phenomenon. However, there is very little and inconclusive evidence from production latencies. To address this issue, I combined a syntactic priming manipulation and a variant of the sentence completion task (cf. V. Ferreira, 1996) to investigate articulation latencies for DA-constructions in German. Prime structure (control, DO, PO) and verb identity in prime and target (same, different) were manipulated. The verbs' preferences for one structural variant (DO vs. PO) served as a predictor in the analyses. Latencies were measured at the case-marked determiner directly following the finite verb (the choice point).

The results showed that a DO prime sentence (compared to a PO prime) speeded up a DO completion in trials both with different and with same verbs, but only if there was a DO preference of the prime verb. For PO completions there was no such effect. Furthermore, in trials with different verbs the choice of a DO vs. PO completion was driven by the constructional preference of the target verb, not by the prime structure. In contrast, trials with repeated verbs showed that a PO prime increased the number of PO completions compared to the DO and the control condition, but that DO and control condition were not different (inverse preference effect). Taken together, these findings support dual mechanism accounts of syntactic priming by pointing towards separate mechanisms associated with syntactic persistence and verb repetition. Moreover, they highlight the impact of verb-bound syntactic preferences on sentence production.

(16)
Language-specific Biases Affect Priming during Message Planning

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Language-specific biases can affect speakers' content selection in the production of motion expressions (Bunger et al., 2013; Konopka & Brown-Schmidt 2014). However, little is known about the role of language biases during message planning. This priming study compares causative motion expressions (The man chased the dog into the house) in English and Mandarin, asking: (1) How does the amount of Path information specified in the priming sentence affect speakers' Path inclusion in the utterance? (2) How does native-language bias affect speakers' sensitivity to recently-activated Path information? Since Mandarin tends to encode Path more prominently than English, using more than one verb rather than a single preposition (Slobin, 2004), and also varies more than English in the amount of detail conventionally used to express Path (Ji et al., 2011), it is hypothesized that Mandarin speakers will be more sensitive to priming of Path than English speakers.

20 English speakers and 20 Mandarin speakers read priming sentences that expressed causative motion aloud in their native language before they described videos depicting different causative motion events. Priming sentences varied in the degree of Path specification: complex (two verbs/prepositions), simple (one verb/preposition), and null (no encoding). The control condition was a non-motion event without Path. Priming effect was assessed using a mixed logit analysis of Path mention. English speakers consistently mentioned Path (86.67%), but showed no priming effect (F (3, 217) = 1.72, p = 0.16). Mandarin speakers mentioned Path more often after reading a complex (81.67%) or simple (91.67%) prime, but less often after reading a null (55.93%) or a non-motion (53.33%) prime, resulting in a significant priming effect (F (3, 216) = 12.58, p < 0.01). Our finding suggests that language bias due to the amount of variation in conventional expression of Path affects sensitivity to recently-activated Path information during message planning.

(17)
Split intransitivity modulates look-ahead effects in sentence planning

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Linguistic analyses suggest that there are two types of intransitive verbs: unaccusatives, whose sole argument is a patient (e.g., fall), and unergatives, whose sole argument is an agent (e.g., jump). Here we examine how real-time planning processes differ for unaccusatives and unergatives. We build on previous extended Picture Word Interference (ePWI) studies on look-ahead effects in sentence planning that show that verbs are planned before uttering a deep object but not before uttering a deep subject. Participants produced unaccusative (e.g., The doctor is floating) and unergative sentences (e.g., the doctor is sleeping) given pictures with corresponding events. Distractor verbs were superimposed on the picture and were sometimes semantically related and sometimes unrelated to the target verb. Both the onset of the preverbal noun and the duration of the preverbal nouns + auxiliary were measured. A delay in noun onset due to the semantically related distractor verb is the evidence for verb look-ahead before noun production. In contrast, elongation of the pre-verbal material would provide evidence that verb planning occurs later, once sentence nouns have already started to be uttered A delay in onset due to semantically related distractors was found in unaccusative, but not in unergative sentences. In contrast, the duration of preverbal noun phrase + auxiliary production was elongated due to the semantically related distractor in unergative, but not in unaccusative sentences. This pattern suggests that verbs are planned before subject noun/auxiliary production in unaccusative sentences, but during subject noun production in unergative sentences. This role-sensitive verb planning accords with linguistic arguments that deep objects have stronger verb dependency than deep subjects, and contrasts with radically incremental or highly flexible models in which linguistic dependencies play no role in lexical planning.

(18)

Verb-bias and verb-specific competition effects during spoken language production

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How do speakers choose between structural options for expressing meaning (e.g., double-object/DO vs. prepositional-object/PO)? We investigated the role of verb bias.

Participants underwent training wherein they saw videos depicting transfer events, heard accompanying DO/PO sentences, and repeated them. Of 10 verbs (e.g., give): 4 appeared only in DO (DO-only), 4 only in PO (PO-only), and 2 equally in DO and PO (Equi). We counterbalanced which verbs appeared in which conditions. During testing, participants freely described videos that involved new puppets and therefore required the generation of new sentences.

DO response proportion was higher for DO-only than for PO-only and Equi verbs. The latter two did not differ from one another. This extends evidence for verb bias effects on spoken production in an artificial language (Thothathiri & Rattinger, 2015) and written production in English (Coyle & Kaschak, 2008) to spoken production in English.

Previous artificial language evidence suggests that Equi verbs--which are associated with two structures--induce competition and recruit different neurocognitive mechanisms than verbs trained in one structure only (Thothathiri & Rattinger, 2015). We corroborated and extended this evidence using natural language stimuli. First, DO utterance duration prior to the DO/PO decision-point (Noun1 + verb) was significantly longer for Equi than DO-only/PO-only verbs. In contrast, PO utterance duration was significantly shorter for Equi than the other verbs. Second, Stroop performance correlated positively with DO response proportion for Equi but not the other two verb types. These results suggest that for Equi verbs, production involved competition between the dispreferred DO structure and the preferred PO structure, and that general inhibitory control might be used to suppress PO to produce DO.

This study shows that verb bias influences spoken sentence production and that competition resolution mechanisms might be used specifically for verbs associated with multiple structures.

(19)

Prospective and immediate stutter anticipations in reading

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Stutter anticipation, i.e., the feeling that a disfluency is imminent, has long been of interest for research on stuttering. Adults who stutter (AWS) most commonly report premonitions of upcoming stutter events. To date, it is not clear what these anticipations are based on. Are they sensitive to inherently linguistic factors i.e., semantic/lexical contents, (the complexity of) grammatical or prosodic structures or articulatory intricacy? Or are they unrelated to the nature of those elements per se and instead are a response to an underlying movement disorder (i.e., disorders of the basal ganglia)?

We tested the quantity and reliability of anticipations in a group of 21 AWS and a matched control group of 21 adults who do not stutter (ANS). In a carefully constructed experimental reading study, participants read six short stories and were asked to report any kind of anticipatory feeling after (i) reading the stories silently on a computer screen (i.e., prospective anticipation) and after (ii) reading the same stories aloud (immediate anticipation).

Both types of anticipations were evaluated in the context of actual reading fluency. Overall, AWS anticipated significantly more than ANS. For prospective anticipation ratings, AWS were able to predict their stutter events to a relatively low degree, while there was a significant increase for immediate anticipation. Linguistic factors were relevant for both anticipations types as well as for the prediction of actual stutter events. However, the relevant linguistic parameters had different impacts on the two types of anticipation. This might indicate that participants used the experience of the actually occurring stutter events to update their internal models regarding stuttering triggers. No correlations were found between anticipation rates and stutter severity or physical concomitants during overt reading. Results are discussed in the context of current accounts of stuttering and possible impacts on treatment.

(20)

Twisting tongues in English and Spanish

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As speakers repeat a tongue twister, they make fewer errors but a greater percentage of errors tend to be anticipatory (Dell et al., 1997). These error patterns are critical for understanding serial ordering mechanisms in language production and how the time course of planning changes as a function of short- and long-term language experience. In an extension with 32 bilingual and 32 primarily monolingual English-speaking adults, participants repeated twisters twice slowly and then quickly 10 times paced by a visual and auditory metronome. Twisters such as "Treefrogs tickle twitchy trout" and "Tres tigres temen trampas" were designed to more easily distinguish between anticipatory and perseveratory sound errors than Dell's original items did.

Descriptive statistics the unsurprising result that errors of all types declined with repetition (from 15.6% for first and second fast repetitions to 6.9% for 9th and 10th repetitions in English). Monolingual and bilingual speakers had similar overall error rates for English twisters (10.0 and 10.8% respectively). Spanish twisters were somewhat easier (7.5% errors for bilinguals). We will report results of analyses of anticipation and perseverations that permit more fine-grained characterization of changes with repetition than available in 1997 and how these patterns may differ based on language experience.

(21)

Production-side noise inference: Comprehenders expect perseverative errors

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Noisy-channel models hold that language comprehension is robust to imperfect, error-prone utterances, favoring non-literal interpretations given low prior probability of the literal message and high likelihood of signal error (Gibson et al, 2013). But these models do not specify whether comprehenders model mechanistic, production-side causes of error. To investigate this, we asked whether comprehenders were less likely to interpret lexical choices as literally intended by the speaker given specific evidence that the choice could be a perseverative speech error. Comprehenders were given sentences and asked 'Did the speaker end up saying exactly what she meant?' Given a context (below) where 'trail' is a probable intended target and 'track' is a potential error, comprehenders were less likely to say that the speaker saying 'track' said what she meant ($p<0.01$). Crucially for the hypothesis that comprehenders model production-side causes of error, this effect interacted with the presence of an earlier distractor 'soundtrack,' which shares a morpheme with 'track' and plausibly motivates its production as a failed intent to say 'trail': following 'soundtrack' (as opposed to 'playlist'), comprehenders were even less likely to think a speaker saying 'track' said what she meant ($p<0.05$). In a second experiment, we additionally manipulated whether the distractor and error words shared a morpheme or were merely phonologically similar ('butter'~'buzzer'), and found that only morpheme-sharing distractors produced the effect---consistent with the higher actual incidence of perseverative errors given shared morphemes (Pillon, 1998). These results indicate that noisy-channel comprehension involves detailed mechanistic knowledge of the production-side causes of error, encouraging further investigation of ways language comprehension may recruit the speech production system (Pickering & Garrod, 2007).

I'm downloading a [soundtrack/playlist] for my hike up the nature [track/trail] to Redwood Summit.

"Yes" responses (participant thought speaker said what she meant):
playlist-trail   83±1%
soundtrack-trail   85±1%
playlist-track   53±2%
soundtrack-track 47±2%

(22)
Syntactic entrainment in aging and aphasia

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Effects such as syntactic priming are viewed as reflecting ongoing language-learning throughout the lifespan (Chang et al., 2006). Gruberg et al. (in prep-a) discovered syntactic entrainment, whereby speakers describe particular pictures with structures they heard describe those pictures previously. They analyze syntactic entrainment as reflecting the association of event features onto syntactic constructions (Goldberg, 1995). As a form of language learning, does syntactic entrainment show a developmental trajectory? Gruberg et al. (in prep-b) showed that syntactic entrainment is more sensitive in children than in adults. Here, we investigate entrainment in older adults, as well as in adults with aphasia, to further explore its developmental trajectory.

Twenty young adults, 20 older adults, and 13 adults with stroke-induced mild-moderate aphasia participated in a collaborative picture-matching game (adopted from Gruberg et al., in prep-a). Participants played the matcher and subsequently director roles with the experimenter, who described pictures using either preferred (active, prepositional dative, and on-variant locatives) or non-preferred structures (passive, double-objective dative, and with-variant locative). We measured whether participants produced the same structures to refer to specific pictures as the experimenter, using a linear mixed effects model (lme4, Bates et al., 2014). Both the entrainment effect (χ^2 (1) = 16.68, p < .001) and entrainment x group interaction (χ^2 (2) = 9.809, p = .007) significantly improved the model fit. Young adults were 13% more likely to produce preferred structures when the experimenter used preferred (75%) vs. non-preferred structures (62%) (p < .001). However, no entrainment effects were shown in older (73% vs. 69%) and aphasic participants (79% vs. 75%). Thus, syntactic entrainment diminishes across the lifespan and is unaffected by aphasic status. This suggests that content-structure mappings stabilize across the lifespan, and that they are independent of the procedural deficit associated with aphasia.

(23)
Zooming in on interaction between planning and articulation through the lens of disruptions

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Experimentally induced disruptions provide a window into processes underlying speech production. Studies exploiting this technique have tended to focus on lexical access, where evidence is compatible with parallel influences of unselected and intended words on processing (Macleod, 1991). Another issue concerns cascade between lexical access and articulation. Cascade models predict that disruptions to lexical access should produce corresponding disruptions to articulation (Goldrick & Blumstein, 2006), however the evidence for such effects is mixed (Damian, 2003; Kello, 2000). These conflicting results could result from individual differences in the stability of processing. When individuals experience high degrees of disruption to lexical access, they will be unable to discretely select a target representation for production. This will allow distortions arising in lexical access to influence articulation. We tested this hypothesis by varying the degree of disruption of lexical access induced by a paradigm that results in semantic substitution errors in picture naming (Ferreira & Griffin, 2003). In Experiment 1, we examined young adult monolinguals; the high level of stability associated with speech production in young adults is predicted to result in weak interactive effects. Two additional experiments were then conducted to examine whether more robust interaction is found when speech production is further destabilized. In Experiment 2, a separate group of younger adults performed the cloze sentence completion paradigm under time-pressure. In Experiment 3, we examined a group of older adults, where the effects of normal cognitive aging on lexical access may naturally increase disruptions at articulation. Our hypothesis predicts there will be increased disruptions to articulation in Experiments 2 and 3 relative to the baseline of Experiment 1. We will discuss the results and consider the implications of our findings for a dynamic account of interaction during speech production.

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(24)
Orthographic effects in Mandarin spoken language production

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For literate individuals, does the spoken production of language involve access to orthographic codes? Previous research has rendered mixed results, with a few positive findings contrasting with a range of null findings. To make progress, one would hence ideally use a task which a) is plausibly sensitive to potential online interactions of sound and spelling, b) has at least some degree of ecological validity, and c) involves a target language in which spelling and sound can be largely dissociated (i.e., a non-alphabetic orthographic system). In the current experiments, we provided this sort of evidence, and chose spoken Mandarin as the target language in order to better dissociate sound from spelling. In Experiment 1, Mandarin speakers named coloured line drawings of common objects with adjective-noun phrases (e.g., /lan2/ /hua1ping2/, "blue vase"). Adjectives and nouns were semantically and phonologically unrelated on all trials, but on critical trials they shared an orthographic radical, which resulted in a significant facilitation effect (see Table 1 below). In Experiment 2, apart from attempting to replicate the central finding, we aimed to extend Experiment 1 in the following ways. First, we used a revised set of materials in which additional care was taken to avoid residual phonological or semantic overlap. Second, to discourage potential strategies, we added a further 12 filler pictures to reduce the percentage of related trials to 25%, and we reduced the number of repetitions of each related/unrelated combination from six to three. Moreover, in the familiarisation phase, we introduced object and colour names verbally (rather than visually) to participants. With the slightly modified materials, and modified various aspects of the design, the orthographic effect from the first experiment was again found. We interpret these results as strong evidence for the claim that retrieval of phonological codes in spoken production involves the co-activation of orthographic representations.

Table 1. Response latencies (in milliseconds; error percentages in brackets) for Experiments 1 and 2.

	Orthographically related	Orthographically unrelated	Difference
Exp 1	970 (0.4)	986 (0.2)	+16 (-0.2)
Exp 2	929 (2.9)	947 (3.0)	+18 (+0.1)

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(25)
Tracking the time course of lexical access in orthographic production: An event-related potential study of word frequency effects in written picture naming

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Over the past decades, a vast amount of research has been dedicated to exploring lexical access during spoken production. By contrast, relatively less work has been directed at lexical access in written production. In the present study, we will focus on the latter issue. Previous studies of spoken picture naming using event-related potentials (ERPs) have shown that speakers initiate lexical access within 200 ms after stimulus onset. In the present study, we investigated the time course of lexical access in written, rather than spoken, word production. Chinese participants wrote target object names which varied in word frequency, and written naming times and ERPs were measured. Writing latencies exhibited a classical frequency effect with shorter response latencies for pictures with high-frequency names than that with low-frequency names. More critically, the ERP results revealed a word frequency effect in the time windows of 175-250 and 250-455 ms, starting at 162 ms after picture onset, with low-frequency responses eliciting more positive amplitudes than high-frequency words (see Figure below). We conclude that lexical access during written word production is initiated within 200 ms after picture onset. This estimate is compatible with previous studies on spoken production which likewise showed a rapid onset of lexical access (i.e., within 200 ms after stimuli onset). We suggest that written and spoken word production share the lexicalization stage. The present findings also provide important insights into the locus of the word frequency. We found that the word frequency effect was present in the time windows of 175-250 ms and 250-455 ms, which are associated with lexical selection and word-form encoding respectively in the meta-analysis by Indefrey and Levelt (2004). It therefore appears that the word frequency effect in our results affected both lexical selection ("lemma access") and word-form encoding, rather than exclusively affecting the stage of word-form encoding.

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(26)
The relationship between speech production and perception representations in different non-native sound contrasts

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Previous studies have suggested a dissociation between speech production and perception for non-native speakers. Being able to reliably produce non-native sound distinctions does not entail accurate perceptual categorization of the same sounds. This dissociation may not be surprising because of the different nature of the production and perception tasks. Reliable production requires a motor-representation while perception requires classification of incoming acoustic properties into categories. In the present study we ask whether the relationship between perception and production change when examining different sound contrasts.

Our previous study demonstrated that native Japanese speakers' who could reliably produce English /r/ and /l/ in some conditions did not reliably perceive the same sounds, adding support to previous studies suggesting that speech production and perception of nonnative sounds may rely on different mechanisms or representations. This may be especially true in cases where the target in perception and production is quite distinct. In the case of English /r/ and /l/ the listener must rely on changes in F3 to perceive /r/ and /l/, but the motor movement involves, for example, tongue retroflexion.

In the present study we examine the production-perception relationship for a nonnative sound contrast where the perception and production targets may be more similar. Specifically, we examine native English speakers' production and perception of Japanese geminate and singleton consonants. For this contrast, both speaking and listening requires a focus on duration. In production, the duration of the closure must be different between singleton and geminate consonants. Similarly, in perception, listeners need to be sensitive to duration of this closure. In such sound contrast, we might observe a different type of relationship between speech production and perception of non-native sounds.

(27)
A Recurrent Neural Network Model of the Development of Child Productive Vocabulary

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Why are some words learned and spoken by children sooner than others? To understand this question, one needs a good model of both the environmental input that children receive AND a good model of the systems that is learning and representing that input. In this work, we modeled the input that children receive using a composite version of the CHILDES corpus (MacWhinney, 1999), containing approximately six million words of child-directed speech to children age 0-5 (approximately 10% of the quantity of words that an individual child would have heard by that age). We modeled how that input was processed and represented using a recurrent neural network. The model learned by trying to predict each word in the input using the previous words it had "heard". As the model made these predictions -- often making mistakes -- it adjusted its internal representations so as to make better predictions over time. As the model did this, it gradually learned internal representations of words that allowed it to predict word sequences in a very accurate manner. Somewhat surprisingly, these representations were also very good predictors of children's productive vocabulary. We used two dependent measures of children's productive vocabulary: 1) MCDI scores (i.e. parent reports of which words children say at a given age), and 2) word frequency of children's word productions in the CHILDES database. A number of measures from the model were significant predictors of both variables, including the model's relative difficulty learning each word, the representational stability of each word in the model, and neighborhood density of representations in the model's memory. Specific details of the way the computational model learns, AND the way the input was structured, had significant impacts on model performance, providing evidence that both factors and their interaction are critical for understanding the development of children's productive vocabulary.

(28)

Linking Hand to Mouth: The Relationship Between Manual Dexterity and Language Skills in Typically-Developing Children

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In recent years there has been growing interest in investigating the relationships between body, action, and mind. For instance, the framework of grounded or embodied cognition is associated with a number of proposals about the important roles that action and bodily experiences play in cognitive processing (Gentsch, Weber, Synofzik, Vosgerau, & Schütz-Bosbach, 2016; Glenberg, 2015). One of the assumptions of the embodied cognition framework is that language may have originated from (Arbib, 2005) or with (McNeill, 2012) action. Thus, although they have typically been examined as separate processes in development, action and language may be linked. In the present study we investigated relationships between children's manual dexterity and language skills to examine the proposal that there are parallels between fine motor and speech development in typically-developing school-age children. Participants were 102 6- to 7-year-old children. We measured children's manual dexterity, auditory naming (spoken word repetition), and word reading skills. Results showed that children's manual dexterity was related to their auditory naming latencies, but not to their reading skills. That is, children with more advanced manual dexterity also tended to have faster auditory naming latencies, which likely reflect faster speech perception and production skills. The results provide new insight about the ways that hand processes and mouth processes may be related in typical development, and are consistent with the assumptions of the embodied cognition framework about links between action and language.

(29)

Frequency affects pronoun production

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Previous research showed that speakers use pronouns more when they refer back to the subject (subjecthood effect); when there is a single entity in the discourse (competition effect); and when there is only one entity that matches the gender of the pronoun (gender effect; Arnold & Griffin, 2007; Arnold et al., 2000). This suggests that pronoun production relies on the accessibility of a referent. One factor known to influence accessibility is frequency. Van Gompel & Majid (2004) showed that the reading times following pronouns with low-frequency (LF) referents are shorter than those with high-frequency (HF) referents, suggesting that frequency influences pronoun comprehension.

The present study aims to examine whether pronoun production is influenced by frequency using a story continuation task (n=52). We manipulated frequency of referent nouns in single entity (the woman (HF)/ postman (LF) skated to the house) and two-entity contexts (Subject-HF/Object-LF: the girl(HF) calmed the monk(LF)/ Subject-LF/Object-HF: the postman(LF) warned the mother(HF)). We also manipulated gender in two-entity contexts.

We found significant effects of subjecthood, gender and competition, consistent with [1,2] (p<.001). In single entity context, there was no effect of frequency. In two-entity context, however, there was a significant interaction between frequency and subject/object referent (p<.05).In subject-LF/Object-HF condition, pronouns for subject referent decreased (87.7% vs. 93.1%) while object referent increased (48.2% vs. 35.9%) compared to Subject-HF/Object-LF condition. Thus, our results suggest that frequency significantly influences pronoun production in the presence of multiple entities.

(30)
Language produced after encountering different metaphorical frames for illness

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Reading different metaphors about an abstract topic can lead people to reason in systematically different ways. For example, reading about crime as a beast prompted people to suggest more enforcement-related solutions than reading about crime as a virus (Thibodeau & Boroditsky, 2011; 2013). Does encountering a metaphor also influence the language that people produce? In a series of experiments, participants read about a person's experience with cancer, framed as either a battle or a journey. After reading the narrative, they wrote additional information they imagined about this experience, such as the patient's mindset or how their relationships would be affected. A corpus analysis of the language produced during this task using the online corpus comparison software Wmatrix (Rayson, 2009) demonstrated that people who read about a battle with cancer produced different language than those who read about a journey with cancer. Specifically, the semantic annotation tool in Wmatrix was used to identify the semantic domains that were significantly overused in one set of responses against the other (p < 0.001). The participants who read the narrative with the battle framing overused the semantic domains of WARFARE (including words such as: 'battlefield' and 'war'), TRYING HARD (including 'struggle' and 'battle'), HINDERING (including 'fight' and 'fighting') and SUCCESS (including 'beat' and 'win'). The participants who read the narrative with the journey framing overused the semantic domain of VEHICLES AND TRANSPORT ON LAND (including 'road' and 'path'). These results show that the participants tended to perpetuate the metaphorical frame they encountered previously. Participants both reused metaphorical words from the original text and also extended the metaphors to include related metaphor-consistent vocabulary. These findings open possibilities for future investigations into the transmission of metaphorical language and conceptualizations.

(31)
Distributional changes in speech: Speakers target hyper-articulation to avoid highly confusable speech

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Recent work suggests that speakers adapt their speech in the presence of phonological competitors (e.g. Buz, Tanenhaus, & Jaeger 2016; Hwang, Brennan, & Huffman, 2015; Kirov & Wilson 2012; Schertz, 2013; Seyfarth, Buz, & Jaeger, 2016). For example, Seyfarth and colleagues found that speakers exaggerate (hyper-articulate) the pronunciation of voiceless and voiced word-final sibilants in the presence of voicing competitors (e.g., saying "dose" when "doze" is a contextually plausible competitor) compared to contexts without voicing competitors.

Such hyper-articulation has been argued as due to competition during lexical planning (Goldrick, Vaughn, & Murphy, 2013) or, alternatively, to communicative goals (Buz, Tanenhaus, & Jaeger, 2016; Schertz 2013). One argument against the latter view is that hyper-articulation leads to small---though significant---changes in mean pronunciation. This conclusion is based on standard analyses of differences in means of phonetic features (e.g., Baese-Berk & Goldrick, 2009; Goldrick et al., 2013). However, articulation is noisy: the same articulatory plan results in a distribution of acoustic realizations. Using a distributional analysis that acknowledges this fact, we ask whether small changes in mean pronunciation are the consequence of speakers specifically avoiding pronunciations that are contextually ambiguous (i.e. closest to category boundaries).

We applied this distributional analysis to two data sets (Buz et al., 2016; Seyfarth et al., 2016). In each of the acoustic measures studied in the data sets we found significant speech differences near category boundaries (voice onset time in Buz et al., 2016; vowel duration and sibilant phonation in Seyfarth et al., 2016). In all cases, the likelihood of ambiguous productions (those close to the category boundary), was lower in the presence of a phonological competitor compared to contexts without a competitor. In an ideal observer analysis, we further find these differences are large enough to have substantial perceptual consequences.

These findings suggest that speakers can dynamically adapt their speech with reference to communicative goals. In contrast, our results are not easily accommodated if hyper-articulation is a side effect of competition during lexical planning.

(32)

ERP contrast of semantic facilitation vs interference in picture naming

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A few ERP studies used the blocked cyclic naming paradigm (BCNP) to investigate lexical-semantic context effects on picture naming in healthy subjects (Aristei, Melinger, & Abdel Rahman, 2011; Ganushchak & Schiller, 2008; Maess, Friederici, Damian, Meyer, & Levelt, 2002). Typical results on reaction times showed semantic facilitation (or no effect) during the first presentation cycle, and interference emerging in subsequent cycles. ERP effects were interpreted as reflecting lemma selection and self-monitoring processes. All previous BCNP studies focused on interference effects and did not take into account the (often facilitative) first presentation cycle. Here we contrasted the time-windows of semantic facilitation (first cycle) and interference (subsequent cycles) in a BCNP.

A group of 24 French-speaking young adults underwent a picture naming task, with pictures grouped either in semantically heterogeneous blocks or in homogeneous blocks. Each picture was repeated three times in each condition.

Behavioral and ERP analyses showed a main effect of condition, cycle and an interaction between these variables. Semantic facilitation was observed in the first cycle (i.e. naming latencies were shorter in homogeneous blocks than in heterogeneous blocks), whereas interference appeared in the third cycle. ERPs differed between heterogeneous and homogeneous conditions from 250ms post picture onset in the first cycle and as early as 160ms post picture onset in the third cycle. In both cases, effects lasted up to 410ms post picture onset.

Using a BCNP we replicated the behavioral semantic facilitation and interference effects described in the literature. Crucially, semantic interference modulated ERPs in an earlier time-window than semantic facilitation. According to actual speech planning time-course estimates (Indefrey, 2011), the early ERP modulations are rather in line with a conceptual locus of semantic interference and a lexical locus of semantic facilitation. Moreover, the late ERP modulations observed both for semantic facilitation and interference probably reflect self-monitoring processes.

(33)
Distinguishing languages from dialects: A litmus test using the picture-word interference task

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University of Dundee

Linguists have been working to develop objective criteria for distinguishing languages from dialects for well over half a century. The prevailing view amongst sociolinguists is that no objective criteria can be formulated. The aim of this study is to examine whether language processing can provide insights into this problem by comparing bidialectal behavioural effects to bilingual effects reported in the literature. Previous research has demonstrated that when bilinguals name an object in Lx while simultaneously processing a translation equivalent distractor word in Ly, naming times are sped up relative to an unrelated condition (Costa, Miozzo, & Caramazza, 1999). Using the same methodology, we evaluated whether a comparable facilitation effect arises when the distractor word is a dialectal variant of the picture name.

72 Scottish participants named 32 common objects in British English while simultaneously seeing or hearing British or American distractor words. Distractor words were either semantically identical to the picture, categorically related to the picture, or unrelated to the picture. Across 3 experiments, we consistently observed between-dialect interference, not facilitation. The polarity of the effect was unaffected by distractor modality or by the accent used to produce the distractor words (e.g., American or British). This behavioural divergence between bilingual vs. bidialectal processing suggests that this paradigm could provide an objective litmus tests for identifying the boundary between dialects and languages.

(34)
Lesions to the Left Lateral Prefrontal Cortex Impair Decision Threshold adjustment for Lexical Selection

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Patients with lesions in the left prefrontal cortex (PFC) have been shown to be impaired in lexical selection, especially when interference between semantically-related alternatives is increased. This has been demonstrated and replicated using the blocked-cyclic picture naming paradigm, in which pictures are presented within semantically-homogeneous (HOM) or heterogeneous (HET) blocks, and are repeated several times per block. Left PFC patients exhibit an increased semantic interference effect (corresponding to worse performance in HOM vs. HET blocks from the first repetition onwards) than age-, education-, and gender-matched controls. In the present study, we use evidence accumulation modeling to investigate which computational mechanism may be impaired following left PFC damage due to stroke. We show that compared to controls, decision threshold adjustment is impaired for patients to appropriately handle the added item difficulty in HOM. Specifically, where decision threshold is increased in HOM compared to HET blocks in controls, this adjustment does not occur in left PFC patients. These results suggest that in cases of left PFC damage, a module in the left PFC cortex may not be accumulating semantic interference anymore in a similar way as for healthy speakers. These results are therefore in agreement with a role of the left PFC in the adjustment of the decision threshold for lexical selection in language production.

(35)

German verb morphology in overt language production: an ERP study

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This study used primed picture naming and event-related potentials (ERPs) to investigate the cognitive mechanism underlying overt language production of regular and two subtypes of irregular verbs in German.

Combining ERP and reaction time measurements in language production studies allows us to observe morphological processing in the time period preceding articulation (Costa et al., 2009; Aristei et. al, 2011). In language comprehension, processing of (ir-)regularity received a lot of scientific attention (Clahsen et al. 1999; Pinker & Ullman, 2002; Smolka et al., 2007) but only few studies addressed (ir-)regularity in language production (Tabak et al., 2010; Budd et al. 2013). The debate centers on whether different types of verbs are stored and processed by different types of cognitive mechanisms.

If that is the case, these mechanism should be affected differently by morphological priming visible both in reaction times and ERPs.

46 participants performed a long-lag primed picture naming task while their electroencephalogram (EEG) was recorded. Primes were past participle verbs (er hat getanzt). We used black-and-white line drawings as targets, which the participants had to named overtly. We manipulated the relationship between primes and targets such that they were either related or unrelated.

The study and its results shed light on the time-course of the production of regular and two subtypes of irregular verbs. It informs us about morphological encoding processes shortly before articulation and hints towards the cognitive mechanisms underlying overt language production. Hence, it provides new evidence in the past tense debate.

(36)

Delayed versus immediate production: An ERP study of morphological processing

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ERP studies of language production are vulnerable to potential articulation-based artefacts (Ganuschak et al., 2011). To address this concern, ERP researchers have experimented with delayed production, where participants give covert responses before making overt responses. For morphological processing, covert production has yielded a replicable ERP effect reflecting morphological encoding: an enhanced negativity for regular (against irregular) past-tense and plural forms in English (Budd et al., 2013; Budd et al., 2015; Festman & Clahsen, 2016). Other research has argued that ERPs can be directly determined from overt speech (Koester & Schiller, 2011) and that there is no need to study covert production. The aim of the current study was to directly compare an immediate with a delayed task of producing morphologically complex words. We tested regular vs. irregular past-participle formation in German.

Design. 58 German native speakers underwent 32-channel EEGs; 31 in the delayed and 27 in the immediate version of the experiment. Both versions had a 2x2 (form-by-regularity) design with 50 items each in 4 conditions. Subjects were visually cued to produce either regular or irregular participle forms or 2nd sg. present-tense forms of the same verbs (latter suffixed with --st to control for lexical effects). In the delayed version, participants were cued to respond covertly then overtly after a 2000ms delay. The immediate version was identical except that the covert response cue was removed.

Results. The delayed version elicited an enhanced negativity for the (covert) production of regular over irregular participles from 300ms onwards (until 450ms) and no difference for the present-tense control condition, replicating previous results on English. In contrast, the immediate version elicited a negativity for irregular participles with a later onset (from 420-500ms).

Conclusions. The timing of the ERP effect in the delayed version is indicative of morphological encoding while that in the immediate version indicates phonological encoding (Indefrey & Levelt, 2004). We suggest that the demands of phonological encoding of irregular forms in overt production exceeded any morphological encoding signals in the immediate production task, and that the delayed version may be more suitable for studying morphological encoding with ERPs.

(37)

Testing the role of auditory feedback in repetition reduction

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Speakers reduce repeated words by making them shorter, quieter, and flatter. Relatively little is known about why this happens. Motor contributions and discourse status seem to play a critical role (Lam & Watson, 2014; Lam & Marian, 2015). More recently, Jacobs et al. (2015) found that speakers reduce whenever the sounds of a word have been introduced into the discourse, citing the role of feedback in controlling duration. They proposed the Auditory Feedback Hypothesis, which states that when speakers have an auditory memory of a word in the discourse, they will later reduce it.

This study attempted to replicate Jacobs et al. (2015). Participants described simple prime-target event pairs by naming objects and actions (e.g. "The dog is shrinking"/"The cat is flashing"). Half of the critical targets were repetitions of the prime (e.g. "The cat is shrinking"/"The cat is flashing"). For half of the experiment, participants described these events either under 90 dB speech noise masking or normal auditory feedback. We predicted that only in normal auditory feedback should repeated target word durations be reduced. We found that repeated targets were significantly shorter under both masking and normal auditory feedback (15 ms and 20 ms reduction effects respectively), but that masking significantly increased durations for target words for both repeated and new mentions (37 ms and 43 ms respectively), demonstrating the critical role of feedback in production.

These results pose a serious problem for the Auditory Feedback Hypothesis because repetition reduction occurs despite degraded auditory memories. One possibility is that some auditory information was received, perhaps through bone conductance, facilitating reduction. We are currently conducting a follow-up study where we are testing whether repetition reduction occurs even when whispering under masking, to further suppress an auditory signal that could be used for feedback.

(38)

Domain-specific control in language production

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Is language production regulated by monitoring for conflict and modulating cognitive control accordingly? If so, how domain-general is this process? We approached these questions by examining conflict adaptation, a sequence effect thought to reflect conflict-driven adjustments of control, in and across linguistic and non-linguistic tasks. In the linguistic Picture-Word Interference (PWI) task, participants named pictures in the presence of a superimposed word that either matched the picture name (low conflict) or was a semantic distractor (high conflict). In the non-linguistic Prime-Probe (PP) task, participants pressed a button to indicate the direction of an arrow that follows another arrow of either the same (low conflict) or different (high conflict) direction.

We ran two experiments. Experiment 1 tested within-task conflict adaptation separately in PWI and PP. Experiment 2 tested cross-task adaptation by alternating the two in a task-switching design. We found reliable within-task conflict adaptation in both PWI and PP, but neither an analysis of individual differences (Experiment 1), nor a direct manipulation of between-task conflict (Experiment 2) revealed cross-task adaptation. Furthermore, we investigated 2-back adaptation in Experiment 2. Because the PWI and PP trials alternated in an ABAB pattern, a 2-back trial always belonged to the same task as the current trial, providing us with a measure of within-task adaptation. Both PWI and PP showed robust 2-back within-task conflict adaptation, even though 1-back cross-task adaptation was absent. Thus, we refute low statistical power and task-switching as potential reasons for our null effect of cross-task adaptation.

These results show that language production is dynamically regulated by monitoring conflict within the production system, but is insensitive to visuospatial conflict. Collectively, these findings support models of conflict-based control in language production that posit at least some degree of domain-specificity.

(39)
Recruitment of cognitive resources during perspective-taking varies with contextual demands

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Previous research has shown that resources such as working memory (WM) and inhibitory control (IC) may matter for how well speakers take their listeners' perspective. We asked how the contributions of these resources change based on linguistic demands in perspective-taking. Twenty-one participants completed a referential communication task in which some trials required the production of an adjective in order to disambiguate a target from a competitor (e.g., "click on the spade under the red raccoon"), while on other trials, the use of an adjective was over-informative. Participants also completed a battery of three tests measuring semantic (category span), phonological (rhyme span) or spatial (Corsi Block) WM, and three tests measuring global inhibition (NoGo) or indirect competitive inhibition (semantic blocking and Flanker).

Speakers produced 142 errors of adjective-omission and 130 errors of adjective-overuse. Analysis of eye-tracking data showed that both error-types were negatively correlated with competitor fixations in an early -but not a late- time window, suggesting the importance of early capture of the critical contrast. To investigate the contribution of WM and IC, we first assessed which types of WM or IC were relevant for perspective-taking, regardless of error-type. These analyses revealed a significant contribution of Corsi Block and NoGo inhibition, respectively. We then examined the relative contribution of each variable to each error-type in a second set of analyses. The results indicated that Corsi Block was reliably predictive of adjective omission, while NoGo was a significant predictor of adjective overuse.

To summarize, our results implicated early localization of the contrast set as a critical factor in successful perspective taking, regardless of the specific contextual demands. Moreover, we found a double-dissociation in resource requirement, such that producing the adjective when necessary was associated with better WM, while dropping the adjective when unnecessary was predicted by better global inhibition.

(40)
Information structure in bilingual Spanish-English child speech

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Adults typically mention old (accessible) information before introducing new (inaccessible) information (Wundt 1990, Bock & Irwin 1980, Levelt, 1989). The 'old-before-new' preference is widely attested in adult language production and proposed as a possible language universal (Clark & Clark, 1978). But child language research suggests that 'old-before-new' is not an early preference, but may develop as a learned strategy (Narasimhan & Dimroth, 2007, 2012). What is the nature and origin of children's 'new-before-old' preference: Is it a language-specific phenomenon in children acquiring a particular language, or is it a universal cognitive preference?

The present study investigates this question in an elicited production of conjoined noun phrases with Spanish-English bilingual children. Participants were 13 Spanish-English bilingual children (mean age 4;1, age range 4-6 years) and 12 Spanish monolingual adult speakers (age range 31–72 years). Each participant watched 12 target pairs of common objects (e.g. a table and a chair) and 12 control items in a slide show. In each target pair, one of the objects was presented first; the participant was asked to name that object, and the experimenter then repeated the name ('old' referent). Then a second object ('new' referent) appeared next to the first object. The participant was asked to describe what he/she had seen. The analysis shows that children preferred the 'new-before-old' word order. But the adults also surprisingly preferred 'new-before-old'. A chi-square analysis reveals that older adult participants (>40 years) preferred the 'new-before-old', whereas younger adults (<40 years) preferred 'old-before-new'. The effect of age is possibly confounded with the level of education, as the older participants did not receive formal education. Our findings suggest a possible language-general early preference for 'new-before-old', and the 'old-before-new' preference may be a learned strategy influenced by multiple factors including age, literacy, and education.

(41)

Response Planning and Execution Dynamics during Form Preparation: New Evidence from Continuous Lip Trajectories

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The homogeneous context of the form preparation paradigm has historically been interpreted as speeding the encoding of the shared phonological fragment. Recent work has led to opposing challenges to this theoretical claim. Some research suggests that block phonological priming with unrehearsed targets permits not just faster encoding, but also speeded incremental articulation of the shared fragment. Other work implies that odd-one-out form preparation with rehearsed targets pre-activates the shared fragment without stimulating encoding. Our own recent unpublished work examining continuous lip trajectories during odd-one-out form preparation found that oral configurations in the homogeneous context (but not the heterogeneous one) were consistent with the target before it was presented. However, that study left several issues unexamined, including whether the effect would hold under more conventional versions of the task, and what if any relationship might exist between the articulatory advantage and the acoustic advantage typically measured.

The present experiment used a form preparation task with pre-rehearsed targets each beginning with /m/, /n/, /p/, or /t/. Sets were fully-homogeneous or fully-heterogeneous with respect to the initial segment. Audio recording was supplemented with video capture of vertical lip aperture during an analysis window spanning 330 ms before target onset to 330 ms afterward. Items in the homogeneous context showed an acoustic latency advantage; this advantage was larger for nasal-initial targets. In the homogeneous context, bilabials were preceded by smaller vertical lip apertures than were alveolars; this contrast manifested as early as 330 ms before target presentation. Pre-target lip movements were overall larger in the homogeneous context, suggesting greater willingness to make advance articulatory commitments when initial segment identity was certain. These articulatory advantages in the homogeneous context (better correspondence with the required place and stronger early commitment) were positively associated with the acoustic latency advantage.

(42)

Changes in semantic and letter fluency in aging

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As the aging population continues to increase, investigations of age-related declines in cognition become increasingly important. Cognitive processes such as processing efficiency, working memory, lexical retrieval and executive function are observed to decline with age (Kirova et al., 2015; Salthouse, 2010); however, vocabulary knowledge is maintained or increases with age (Kavé et al., 2010). To investigate factors that contribute to such asymmetries, we analyzed verbal fluency data from 85 adults ranging in age from 30 to 89.

Verbal fluency is widely acknowledged to require both cognitive (e.g. working memory, processing speed, self-monitoring) and language (vocabulary, lexical retrieval) processes (Troyer et al., 1998). We correlated responses from semantic (animals) and letter (FAS) fluency tasks with age, education, digit span, vocabulary, speed, and accuracy of lexical retrieval. To look for qualitative differences in patterns of retrieval, we counted words produced in each 15-second increment by younger, young-old, and older subjects.

As in previous studies, total words produced declined more drastically with age in semantic fluency ($r=-0.451$, $p<.0001$) than in letter fluency ($r=-0.260$, $p<.05$). Digit span also contributed to both semantic ($r=.401$, $p<.001$) and letter fluency ($r=.429$, $p<.0001$), as did naming accuracy (semantic: $r=0.388$, $p<.001$; letter: $r=0.306$, $p<.01$). Semantic fluency was predicted by naming latency ($r=-0.378$, $p<.001$), whereas letter fluency was strongly predicted by vocabulary scores ($r=0.493$, $p<.0001$). The three age groups demonstrated similar patterns of retrieval across successive 15-second increments.

These findings suggest that semantic fluency depends heavily on online lexical retrieval (disadvantaging older adults), whereas letter fluency allows individuals to take advantage of their vocabulary knowledge (benefiting older adults). Ongoing analyses include clustering and switching measures to investigate the role of executive function, error analyses, and further analysis of the influence of individual differences in cognitive and language skills across the time course of the tasks.

(43)
Competition affects voice onset time differently for voiced and voiceless stops

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Competition among lexical items correlates with hyperarticulation (Baese-Berk & Goldrick 2009), but it is unclear how best to operationalize this competition. We tested various competition metrics to evaluate which were most predictive of voice onset time measurements in the Buckeye Corpus (Pitt et al. 2005). The metrics used included three neighborhood densities targeting the position of change (first segment, second segment, and the rest) and six neighborhood densities targeting the type of change (same and different place, manner, and voicing), along with the total neighborhood density (Luce & Pisoni 1998) and phonetically specific minimal pair existence (Baese-Berk & Goldrick 2009). Each metric was included in a linear mixed-effects model and compared using Akaike's Information Criterion (AIC) and evidence ratios (Burnham & Anderson 2002).

Voiced and voiceless stops were analyzed separately. For voiced stops, the model including whether or not the minimal pair competitor for voice onset time (e.g., bat ~ pat) exists had the most support (Δ AIC = 0). Existence of a voiceless competitor correlated with shorter voice onset time on average (~5ms) for voiced stops. No other models had substantial support (Δ AIC > 2). There was 17.97 times more evidence for the minimal pair model than the model with no competition metric.

For voiceless stops, the model including the number of competitors whose initial segments are also voiceless had the most support (Δ AIC = 0). However, four other models also had substantial support (Δ AIC $\leq$ 2) and there was only 1.19 times more evidence for the initial voiceless competitors model than the model with no competition metric, a difference generally assumed to be negligible (Burnham & Anderson 2002).

These results suggest that different underlying phenomena may be at play for voiced and voiceless stops, yielding different competition effects.

(44)
Morphophonological patterns influence past-tense production

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Previous research has indicated that the distribution of morphophonological patterns within the lexicon impacts the morphological productivity of both regular and irregular verb changes (Albright & Hayes, 2003). The present study examined the past-tense production of 17 individuals with aphasia to determine whether the distribution of morphophonological patterns also impacts the production of known words. We quantified how likely a verb is to take a given past-tense affixation pattern using the Albright-Hayes learner which calculates a "confidence score" for each verb based on the number and proportion of phonologically similar verbs in the language taking same inflectional pattern. Higher confidence scores are associated with words with a large number phonological neighbors that take the same inflectional pattern (e.g., sleep→slept, weep→wept, sweep→swept, etc.).Importantly, both regular and irregular verbs are subject to these differences.

Participants were administered a past-tense elicitation task (e.g., "Every day I run a mile. Just like every day, yesterday I ____ a mile"; n=315, [2988 total productions]). Logistic-regression mixed-effects models were used to assess the impact of confidence score on production above that of other lexical variables. Confidence score was a significant predictor of performance for both regular and irregular verbs. Regular verbs with higher confidence scores were more likely to be produced accurately (β=0.174, z=2.005, p=0.044). For irregular verbs, words with lower confidence scores were more likely to be regularized (e.g., dig→digged; β=0.311, z=2.872, p=0.004).

Distributions of morphophonological patterns predicted the rate at which the regular past-tense rule is applied, both correctly in regular verbs and as errors in irregular verbs. These results extend previous findings and indicate that the distribution of morphophonological patterns within the language impacts the production of known words, a finding which requires explanation within accounts of morphological production.

(45)
Second-language lexical knowledge benefits first-language lexical retrieval

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In several studies, bilinguals have been shown to take longer to name pictures than monolinguals, even when both groups are naming in their native and dominant language (e.g., Ivanova & Costa, 2008). In this study we investigated how second language (L2) lexical knowledge affects the speed of lexical retrieval in the native and dominant language (L1).

A lexical-level interference account predicts that as L2 proficiency increases, so does the degree of competition by L2 words when retrieving L1 words. Additionally, interference will be observed in the L1 only when the L2 translation is known, thus leading to slower lexical retrieval for L2-known L1 words than L2-unknown L1 words. An L1-mediated account (such as the Revised Hierarchical Model: Kroll & Stewart, 1994) proposes that L2 words are accessed through their L1 translation equivalents. This predicts that L2-known L1 words would be retrieved more quickly than L2-unknown L1 words because these L1 words are activated every time the L2 word is used.

We tested 42 native speakers of Brazilian Portuguese with varying levels of English (L2) proficiency (mean age 26.1) who had begun learning English in adolescence or adulthood and had been living in New York for 4.4 months on average at time of testing. They named 140 black-and-white drawings as quickly as possible in Portuguese and later named the same pictures in English. We analyzed the L1 naming latencies using mixed-effects modeling with crossed random effects, controlling for lexical frequency and cognate degree. We found that L2-known L1 words were named more quickly than L2-unknown L1 words, and that this was true for both high and low L2 proficiency individuals.

The findings are in line with an L1-mediated activation account and not with a lexical-level interference account for bilingual lexical retrieval.

(46)
Factors influencing variability in native and non-native speech production

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A common assumption in research on non-native speech is that non-native speakers are more variable than native speakers, both within and across talkers. However, relatively few studies have directly examined this claim directly. Those that have show mixed results: Some studies demonstrate that non-native speakers are more variable than native speakers, while others show the reverse pattern with native speakers demonstrating more variability in their productions. For example, we have recently found that native Japanese speakers show more variability in their realization of voiced stops in Japanese than non-native speakers, and that non-native speakers do not show substantially more variability within vowel categories than native speakers (Vaughn, Baese-Berk, & Idemaru, under review). This mixed evidence is particularly interesting since variability in productions is often indicted as a cause of difficulty in understanding unfamiliar speech, and specifically of difficulty in understanding non-native speech. It also underscores the need to consider the sources of variability of different linguistic features, which we take up in the present study.

Here we examine some factors that may influence variability in speech, specifically native English speakers' and native Japanese speakers' productions of English /r/ and /l/. Participants either read targets containing English /r/ and /l/ or repeated them after an auditory prompt. Preliminary results suggest that non-native speakers are more variable in their realizations of /r/ and /l/ overall. However, a number of factors influence the variability of productions of both native and non-native speakers including the task during production (e.g., reading, repetition, or delayed repetition) and position of the contrast (e.g., onset, intervocalic, or coda). These results suggest that the causes of variability may be wide ranging, and that analyses of variability may yield important insights into speech production mechanisms that a comparison of central tendencies may not.

(47)

Language switching costs in picture naming: Evidence from highly proficient Chinese learners of Japanese

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Past research showed that when bilinguals shift between two languages, switching back from their non-dominant language to their dominant language incurs larger cost than vice versa. This asymmetrical switching cost has been explained by Inhibitory Control model, which suggests that bilinguals suppress the dominant language deeper while the non-dominant language is used, thus when the dominant language is used again more recovery cost is needed than the other way around (Green, 1998).

Current study investigated whether the use of dominant and non-dominant languages would be affected after participants perform language switching, and if so, how the use of two languages would be affected by it. Highly proficient Chinese Japanese-learners (n=17) performed a picture-naming task and the reaction times were measured. In Block 1 and 3, participants were asked to name the pictures on the screen only using Chinese or Japanese (no-switching task). In Block 2, they were asked to name the pictures either in Japanese or in Chinese (switching task). In the switching task, the background color of the pictures was used as a cue to signal the language to be used.

The results showed that in Block 1 participants performed the picture-naming task significantly faster in their L1 than in their L2. However in Block 2, the reaction time for the task was significantly faster in their L2 than in L1, which suggests an inhibitory switching cost. More importantly, the same result was observed in Block 3; participants performed the task significantly faster in their L2 than in their L1. Together our results suggested that highly proficient Chinese learners of Japanese suppress their dominant Chinese deeply when performing the picture naming task using the weaker non-dominant Japanese, and the state of inhibition was rather long lasting and affected their language use even when the switching was not required.

(48)

Language Selection at Multiple Levels: The Time Course of Facilitation and Interference Effects in Cognate Production

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Cognate facilitation and cognate interference in bilingual word production have been elicited separately in different experimental paradigms. In this study we created conditions that would lead to both facilitation and interference during the same retrieval attempt, and identified the points in the production process at which the two phenomena manifest. In a script production task, bilinguals (n=24) translated cognates and noncognates from English (L2) to Romanian (L1) and typed the translations. Latency to type the first letter of the translation (lexical latency) and latency to type the complete sequence of all orthographic segments (orthographic latency) were recorded. Lexical latency was shorter for cognates than for noncognates (facilitation) but orthographic latency was longer for cognates than for noncognates (interference). Dual activation of overlapping sublexical nodes assisted as well impeded retrieval of cognates; however, these distinct effects occurred at distinct levels during the course of retrieval and production. That is, facilitation occurred at the onset of the response whereas interference occurred during orthographic execution of the response. Serial manifestation of facilitation and interference observed in this experiment accounts for a bilingual system that is characterized by cross-language permeability (even when responding in L1), with a selection mechanism that can operate efficiently at the lexical level but inefficiently at the sublexical level. This suggests that the process of language selection is not a one-time event, and selection at one stage does not necessarily guarantee selectivity at subsequent stages. We propose a model of bilingual language production that accommodates this phenomenon. That is, accurate retrieval and production of all segments of a word may require multiple selection mechanisms and multiple loci of selection, perhaps one at each level of production. For this reason, fine-grained linear and temporal tracking of each sublexical segment should be considered when assessing cross-language influences in retrieval of cognates.

(49)
Structural priming across the lifespan

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Structural priming (SP) is the tendency to repeat aspects of syntactic or semantic structure (Bock, 1986; Chang et al., 2003), with lexical overlap between prime and target increasing the size of the effect (=lexical boost; Pickering & Branigan, 1998). In production, two distinct mechanisms have been proposed to underlie SP: implicit learning, for abstract priming, and explicit memory, for the lexical boost (Dual-Path Model: Chang et al., 2006).

Does SP change across the lifespan, and what can this tell us about the mechanisms underlying it? Explicit memory abilities (EM) are known to decline with age, while implicit memory (IM) stays intact (review: Fleischman, 2007). Thus, we might expect that older adults will show a decline in the size of the lexical boost but not of abstract priming. To test this, we devised an animation description task on MTurk (N=192; age range=18-70). We found no dissociation between abstract priming and the lexical boost across the lifespan (ps>.1); instead, both effects had the same size across our age range (cf. Eun Sung, 2015, for lexically-specific priming). Two possibilities present themselves: (1) the lexical boost is not a product of EM, or (2) EM decline in older adults is not dramatic enough to lead to differences in priming.

These findings make two concrete contributions to the field. First, they demonstrate that two primary effects (abstractpriming/lexical boost) that have been observed in college samples are robustly present across the lifespan (supplementing prior findings on SP in aphasics and amnesiacs; also Alvarez et al., 2006, for abstract priming). Secondly, our online task is well-suited for more rigorous, large-scale work on the role of individual differences in SP. We propose one such study that explores the correlation of priming with measures of EM and IM to more directly assess the predictions of the Dual-Path Model.

(50)
Parallels between Action Priming and Syntactic Priming

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Syntactic priming, the tendency to re-use a recently-produced sentence structure, may be similar to a phenomenon in action research termed "hysteresis," the tendency to reuse a previously executed abstract motor plan, such as a hand movement. Here we begin an investigation of whether the hysteresis-syntactic priming similarities are circumstantial or whether syntactic priming may be a special case of hysteresis in motor planning more generally. Our first step is to study priming effects in parallellanguage production and motor tasks performed by the same participants.

The two tasks had identical sequences of primes (prime direction manipulated between subjects), targets, and fillers. The language task used target pictures that could be described with double object (The girl gave the boy a book) or Prepositional Dative constructions (The girl gave a book to the boy). Targets were preceded by two prime sentences that participants read aloud. Fillers were a mix of sentences and pictures prompting intransitive utterances. Target trials in the motor task required participants to touch a series of dots on the screen, with the option of first moving leftward or rightward from a starting dot. Two preceding prime trials contained a dot display with arrows that required leftward or rightward motion from start. Fillers were vertical dot arrays requiring no left or right motion. Thirty-nine native English speakers completed both tasks, with task order counterbalanced.

The primed sentence structure was produced more often (57% of all dative utterances to target pictures) than the unprimed structure (43%). Similarly, target motor trials yielded 67.5% use of the primed hand direction and 37.5% in the unprimed direction. These results establish that parallel tasks can yield similar hysteresis/syntactic priming in the same group of participants, which will form the foundation of future investigations of the extent of parallels between syntactic and motor re-use.

(51)

Garden-path sentences: perspectives from a production task

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We explore the production-comprehension relationship. Certain verbs (e.g. hunt/undress) occur with or without objects, creating ambiguities: In ex(1), comprehenders first analyze "deer" or "baby" as objects and should later re-analyze them as subjects. However, misinterpretations linger after sentences have ended, so it is unclear whether re-analysis is successful (Ferreira/Henderson'91, Christianson et al.'01).
(1a) While the man hunted the deer ran into the woods.
(1b) While the mother undressed the baby spit up on the bed.
Given the growing body of work on the production-comprehension relationship (e.g. MacDonald'13), it is striking how little is known about the production -- especially the frequency of transitive/intransitive usages -- of these verbs.
In a sentence-continuation study (N=34), we investigated how frequently two kinds of transitivity-alternating verbs are used (in)transitively: (i) Optionally-transitive verbs (OPTs) e.g. "hunt" (intransitive: unspecified object) and (ii) Reflexive-absolute transitive verbs (RATs) e.g. "undress" (intransitive: 'self'-interpretation). We also manipulated whether plausible objects were mentioned in the context (ex.2-3).
(2a) A deer was drinking water by the lake. While the man hunted...[OPT/Plausible_object]
(2b) It was a beautiful afternoon. While the man hunted...[OPT/No_plausible_object]
(3a) A baby was lying on the bed. While the mother undressed... [RAT/Plausible_object]
(3b) The heat was almost unbearable. While the mother undressed...[RAT/No_plausible_object]
Overall, 55% of continuations were transitive. Strikingly, with OPTs, context manipulation had no effect (59.3% vs 58.8% transitives), but with RATs, prior mention of plausible objects increased the proportion of transitive continuations (t>|2|, 43.6% to 57.8%).
RATs and OPTs are frequently intransitive but their transitivity biases are differentially influenced by context. If frequency in production relates to ease-of-comprehension, presence of objects in ex(1a,b) is relatively unexpected and a previously-unacknowledged source of processing difficulty. Furthermore, the differential context effects on the rate of transitive continuations highlight the need to explore verb-type differences more carefully.

(52)

Attraction from afar: What influences verb number choice in Basque sentence production

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It has been found that the subject-verb number agreement in production can be interrupted by another noun in the sentence ("attractor"), leading to erroneous number on the verb. In this study, we investigate whether an attractor can influence subject-verb agreement, rather than disrupt it, and whether this can occur when the attractor is not linearly intervening between the subject and the verb – an issue receiving mixed evidence in previous literature (e.g. see Vigliocco & Nicol, 1998 for supporting evidence and Franck et al., 2006 for the opposite). To test this, we make use of Basque, in which genitive modifiers precede the head nouns, and we manipulate their number. The participants were presented with the preambles containing a genitive modifier – the attractor – in either singular or plural, and a head noun marked with -ak, which is in Basque ambiguous between ergative singular and absolutive plural (e.g. gaixoaren[SG.GEN]/ gaixoen[PL.GEN] nebak[SG.ERG/PL.ABS], 'the brother(s) of the patient/patients'). The task was to complete the sentences in written form. We tested whether the number of the preceding attractor influences the disambiguation of the subject noun towards ergative singular or absolutive plural, and consequently the choice of the verb. Generalized linear mixed models analysis showed that more ergative singular constructions were used after the singular genitives (58%) and more absolutive plural constructions were used after plural genitives (59%; z value= 3.45; p<.01).This suggests that the singular/plural number of the attractor can influence subject-verb agreement in sentence production, even when the attractor is not linearly intervening between the subject and the verb. Current ongoing work is testing this effect in an online study, where the same materials are used within an oral sentence production paradigm.

(53)

Learning verb structures: Do speakers only learn what they see?

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When learning new words, speakers not only have to learn their meanings, but also how to use them grammatically in sentences. This is especially important for verbs, which provide the overall grammatical frames for sentences. How do adult speakers learn the grammatical properties of novel verbs? One possibility is that adults' learning stays close to relevant evidence, so that they only use verbs in the ways they experienced them. For example, if adults hear "gomp" only in double object dative (DO) sentences such as "Paul gomped Tina the coat", they may infer that the "gomp" can only be used in DO sentences such as "Spencer gomped Jordan the paint". Alternatively, adults may rely on their knowledge of how existing verbs are used. In English, most verbs that can be used as DOs can also be used as prepositional datives (PDs). This suggests that if someone experiences "gomp" in DO sentences, they might subsequently use it also as a PD (e.g., "Spencer gomped the paint to Jordan") even if they never experience "gomp" with PDs.

We tested this using a pre-test/exposure/post-test design. Pre- and post-test were identical, wherein speakers produced sentences with novel verbs. During exposure, speakers read sentences containing novel verbs in DO or with-locative structures. We measured changes in speakers' produced sentence structures from pre- to post-test. We found that for verbs exposed in DO structures, speakers produced more DOs and PDs at post-test, but not for verbs exposed in with-locative structures. Thus, speakers evidently rely on how existing verbs are used when learning the grammatical properties of novel verbs.

(54)

Competing plans explain agreement errors

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Subject-verb agreement errors can be elicited in response to sentence preambles varying in number inflection (e.g. The key to the cabinets were rusty; Bock & Miller, 1991). Errors also occur in repeated preambles, frequently involving changes to noun inflections that resolve with a locally coherent verb (e.g., The key to the cabinet_ was rusty). We present a neural network model in which verb and preamble errors both emerge from the parallel consideration of possible sentence structures.

The model is instantiated in the Gradient Symbolic Computation framework (Smolensky, Goldrick, & Mathis, 2014), in which symbolic structures are realized in a continuous activation space. During production of a sentence, multiple syntactic structures are simultaneously activated. Over the course of planning, the network moves toward a state corresponding to a discrete symbolic structure, optimizing grammatical constraints on symbolic well-formedness.

Elicitation of preamble completion is simulated by presenting the model with a noun phrase containing two nouns varying in number inflection. It then plans a complete sentence. The model's grammar generates two sentence structures, a frequent structure corresponding to a complex noun phrase with an agreeing verb (e.g. [[Ni Nj] Vi]), and an infrequent structure corresponding to a sentence with center-embedding ([Ni [Nj Vj] Vi]). During planning, the model activates structures partially consistent with the input, resulting in graded parallel activation of both sentence types. When planning complex phrases with single verbs given limited processing resources, the partial activation of the center-embedded structure can result in agreement and preamble errors.

(55)
Language recovery in aphasia following implicit structural priming

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Structural priming occurs via transient activation of a prime in short-term explicit memory (Branigan et al., 2000; Levelt & Kelter, 1982) or through longer-lasting implicit learning (Bock & Griffin, 2000; Chang et al., 2006). Both explicit and implicit priming facilitate sentence production in speakers with agrammatic aphasia (Saffran & Martin, 1997; Hartsuiker & Kolk, 1998; Cho-Reyes et al., 2016). However, it remains unclear (a) whether structural priming can be utilized to target long-lasting language recovery in aphasia and (b) if implicit vs. explicit structural priming would result in different treatment outcomes. We report an ongoing study examining the effects of implicit and explicit structural priming on language recovery in agrammatic aphasia.

Two agrammatic participants (MJ and RS), matched in severity and language profile, were trained on production of prepositional-dative (PD) sentences (e.g., 'the boy is giving the guitar to the singer'). MJ received implicit priming treatment, with four intervening unrelated sentences and no lexical verb overlap between prime and target. RS received explicit priming treatment with no intervening sentences and the same lexical verb. MJ significantly improved in her production of trained as well as untrained PD sentences (from 0% to 90-100%) post-treatment. Importantly, MJ's treatment effects were maintained at a 4-week follow-up and resulted in improved performance on narrative speech tasks, as measured by increased productions of correct information units (18.5% change) and sentences with correct argument structure (3 to 18). Conversely, RS did not show reliable treatment outcomes after the explicit training; although he showed moderate improvement in producing trained PD sentences (0% to 40%), no generalization and maintenance effects were shown. Although preliminary, the current findings suggest that structural priming treatment, particularly implicit structural priming, may remediate procedural deficit in agrammatic aphasia, resulting in long-term global language recovery.

(56)
Facilitatory effects of syllabic frequency in aphasic speech production: evidence from patients with phonetic and phonological impairments

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This paper is concerned with syllabic frequency effects in Spanish speaking aphasic patients. 4 Broca's and 3 conduction aphasic patients, traditionally opposed in terms of the underlying nature of their speech impairment (primarily phonetic in Broca's aphasia and phonological in conduction aphasia) were tested in reading and repetition of isolated bi- and trisyllabic words. The observed segmental substitutions included voicing, place and manner of articulation substitutions (N=659), from which 268 substitutions in CV syllables, varying in frequency, were retained for further analyses.

In the first experiment we compared the frequency of the target syllable to the frequency of the syllable produced as a result of a segmental substitution error. The difference was coded into a binary variable (error>target and target> error) and a logistic regression mixed model was built to test the effect of pathology on this difference. The result showed no difference between aphasic groups: in both groups produced syllables (i.e. containing a substitution error) were globally less frequent than the target.

In the second experiment we tested whether the syllabic frequency of the target syllable predicted the accuracy (i.e. presence vs. absence of a segmental substitution error) in each aphasic subject (N=7). The result of regression analyses show a facilitatory effect of syllabic frequency in 2 out 4 Broca's aphasic patients and 2 out of 3 conduction aphasic patients.

These results are discussed in relation to the mental syllabary hypothesis as proposed by Levelt and Wheeldon(1994) and a potential impairment to access it in expressive aphasia.

(57)

Language treatment improves online sentence production processes in aphasia: Evidence from eyetracking

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Introduction. Sentence production is often impaired in individuals with aphasia in both offline and online tasks, and while offline production improves with treatment, little is known about how (or if) online sentence production is influenced bytreatment.

Methods. The present study used eyetracking to examine changes in sentence production resulting from a 12-weeklanguage treatment program focused on passive sentences (Treatment of Underlying Forms (TUF); Thompson & Shapiro, 2005). In two pre-treatment and two post-treatment sessions, nine participants with mild-to-moderate agrammatic aphasia repeated prime sentences (active or passive), and used the same verb and sentence type to describe a subsequently-presented event picture. We examined the effects of language treatment on picture description responses, including accuracy and eye movements to the pictured Agent and Theme during each sentence region (e.g., [PreN1 The [N1 man was] [V lifting/lifted by the] [N2 woman]), reflecting lexical and grammatical encoding processes. Ten unimpaired older adults also performed the task to identify normal performance patterns.

Results. Unimpaired controls performed with high accuracy and their eye movements indicated encoding of N1 during the PreN1 region and encoding of N2 during the N1 and V regions. In participants with aphasia, offline picture description accuracy improved significantly with treatment for passive sentences, and post-treatment but not pre-treatment eye movements were qualitatively similar to those of unimpaired controls, showing evidence of successful encoding of sentence constituents. However, reduced incrementality as compared to unimpaired speakers (i.e., N2 was encoded after production of N1) also was observed, indicating residual sentence production planning deficits.

Conclusion. These findings indicate that treatment supports re-learning of both offline and online sentence production, with the latter reflecting changes in some cognitive strategies used to produce sentences. The emergence of more normal-like sentence production suggests that, rather than teaching compensatory strategies, treatment enhances access to normal processing routines.

(58)

Pickiness and privilege come at a cost: Syntactic diversity effects in bare-noun picture naming

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Does syntactic information affect the production of bare nouns? Results are mixed on this point; however, some affirmative evidence comes from recent research using semantic blocking and picture-word interference techniques. These studies have found that independent pre-activation of syntactic categories (i.e., word class) can facilitate naming of a word from that category, even for the supposedly non-syntactic bare-noun naming task. These studies have so far explored only word-specific features, such as a word's gender or whether it is a mass or count noun. However, word-independent syntactic distributions may also play a role. Studies of word reading have shown that syntactically picky words are recognized slower than less discriminating words. These studies examined the distribution of nouns within prepositional phrases, and found that when they occurred more frequently across a broader array of prepositions, they were recognized faster. We extend this research into production, testing whether nouns that are more syntactically flexible are produced faster, as well. We go beyond prior research by considering total flexibility, that is, the distribution of a word across all of its syntactic relationships. Using a grammatical representation known as Dependency Grammar, we introduce three novel measures of syntactic flexibility: one based on the relations stemming from the noun, one based on the relations extending to the noun, and an aggregate measure that combines both of these types. We correlate these measures with reaction times in a bare noun picture-naming task (as well as a previously published database of production latencies). Our results show that nouns that project a diverse array of structures are produced faster, and those that are integrated into a diverse array of structures are produced slower, with no effect for the aggregate measure. Crucially, these effects are independent of frequency and a number of other variables known to impact naming latencies.

(59)
How differences between child-directed spoken and written language may have consequences for early language production

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The ability to produce complex sentences emerges after years of experience with one's linguistic environment, and individual variability exists at all points in the developmental trajectory. Known variability in spoken and written language (Roland et al., 2007; Biber 1988) affects language production skills in older children and adults via text exposure (Montag & MacDonald, 2015). Even in pre-literate children, text exposure (being read to) is associated with productive vocabulary benefits (Payne, Whitehurst & Angell, 1994; Sénéchal & LeFevre, 2002). What are the differences between child-directed spoken and written language, and can these differences account for some of the positive language outcomes associated with reading to children?

Substantial differences exist between child-directed speech contained in the CHILDES corpus (MacWhinney, 2000) and a corpus of the text of children's 100 picture books (Montag, Jones & Smith, 2015). The text is more lexically diverse (Montag et al. 2015), and additional analyses show that the books contained longer words, and different patterns of some closed-class words (conjunctions, pronouns). Further, the books contained a greater proportion of complex sentences. Passive sentences were 14.8x more common and complex sentences (5 types of relative clauses) were 5x-39x more common in books. Interestingly, the structure patterns in child-directed sources mirrored those in adult-directed sources not only in relative frequency (which types were more common) but in absolute frequency as well: complex sentences were more frequent in child-directed texts than in adult-directed speech. Picture books may provide an important source of linguistic input for those children who are exposed to them.

These patterns suggest two important avenues for language production research: What are the constraints on the production system such that the written and spoken domains are so distributionally dissimilar regardless of target age, and what are the consequences of these differences for language comprehension and language learning?

(60)
Priming Implicit Communication

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Speakers must choose whether to communicate explicitly or implicitly. They can be explicit, and say exactly what they mean, or they can be implicit, and let the listener do the work (e.g., Grice, 1975). In this study we investigate whether their choice is influenced by whether their conversational partner is communicating implicitly; in other words, whether implicit communication can be primed (e.g. Bock, 1986).

We used a communication game modelled on Branigan, Pickering, and Cleland (2000). The speaker described a preselected card and the addressee had to identify it. Speakers could use either an implicit construction, which meant that to identify the target card, the addressee had to use a conversational implicature (Grice, 1975), or an explicit construction, in which they did not. The form of utterance used by the participant (implicit vs explicit) was the dependent measure. In Experiment 1 (N=40) we used a between-subject manipulation in which a confederate used either explicit expressions or implicit expressions to refer to the target card. We found that participants in the explicit condition used more explicit expressions than those in the implicit condition. In Experiment 2 (N=20) we manipulated the priming within- subject and found similar results.

Our findings demonstrate that the decision to communicate implicitly depends on the style embraced by the conversational partner. The only previous suggestion about why people communicate implicitly is that they do so for reasons of politeness (Brown & Levinson, 1978) and our results cannot be explained in this way. We suggest our effects arose from two potential sources (1) we primed abstract, meaning- based structures associated with conversational implicatures, along the lines of syntactic frames (Pickering and Branigan, 1998), or (2) we primeda conversational style associated with being generally implicit. The within-subject findings in Experiment 2 suggest the former explanation.

(61)

Conceptual representations of edited words linger in working memory: Evidence from pronoun production

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Past research on self-corrections has shown that the syntactic properties of a reparandum influence the processing of the repair (Lau & Ferreira, 2005). However, it is not known whether semantic properties of the reparandum also linger and influence processing. We conducted a spoken sentence continuation experiment to examine whether the reparandum affects form of reference to potential antecedents, including the repair. We manipulated NP Position (NP1-subject vs. NP2-object) and Fluency (Fluent vs. Disfluent). The reparandum and the repair were always gender congruent. Thus, a lingering reparandum should produce semantic interference and reduce pronominal reference to the repair (Arnold & Griffin, 2007). The results revealed: (a) more overall pronoun use for NP1 than for NP2, suggesting that syntactic prominence leads to more pronoun use, (b) More pronoun use overall in the Fluent than in the Disfluent condition, suggesting that Disfluency reduces the overall activation of the antecedents. Importantly, however, (c) there was no reliable interaction between NP Position and Fluency, indicating that reparandum's gender information is not retained in working memory, resulting in no semantic interference when reference was made to the repair. These results suggest that an abstract conceptual representation of the reparandum (and not its specific gender information) lingers in memory and influences processing. We offer three interpretations of our results: First, the reparandum may linger in memory, making the total number of antecedents in discourse three rather than two, thereby reducing overall activation levels. Second, suppressing the reparandum might consume cognitive resources and reduce overall activation of all potential antecedents. Third, speakers might believe the "other speaker" is confused about the utterance, and therefore might produce full nouns to reduce confusion for their interlocutor. The lack of semantic interference could be due to shallower processing when the utterance is harder to process (i.e., contains a disfluency).

(62)

Measuring articulatory reduction in silent gesture

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Givenness and predictability lead to the production of reduced linguistic forms. These reduced forms are typically less acoustically prominent, have shorter syllable lengths, and occupy a smaller and more centralized vowel space (e.g., Breen et al. 2010; Watson et al 2008; Ablett & Turk 2004; Bell et al. 2003). Given referents are also more likely to be referred to with fewer modifiers, pronominally, or not at all (e.g., Arnold 2010; Nariyama 2004). Additionally, gestures which accompany descriptions of objects in the common ground are less elaborate than those accompanying descriptions of novel objects (Gerwing & Bavelas 2004). In this project, we investigate whether these reductions in form and specification also occur in a different type of communicative context, as interlocutors create and converge upon a shared set of gestural symbols to refer to concepts in the common ground. We asked 10 pairs of participants to communicate about the same set of 36 English nouns, repeated over 4 rounds. Participants switched from giving and receiving clues halfway through each round, and, in Rounds 2-4, participants were asked to use only silent gesture to communicate. The gestures produced by participants were measured using the Microsoft Kinect, which tracked in 3D each participant's joints when they were gesturing. Additionally, we segmented and coded each gesture for the meaning represented. We found reduction in form, as the size of the articulatory space and distance traveled by the wrists decreased significantly across rounds for each gesture. The gestures also became less specified, as participants used significantly fewer meanings to name referents which had been gestured about in previous rounds. Using the Kinect, we were able to measure articulatory reduction in gesture analogous to previous work on reduction in speech as participants converged on and repeatedly referred to concepts in the common ground.

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