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Dichotic listening with specific, general, abstract and emotional words – semantic judgments and reaction times.

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The Ninth International Conference on the Mental Lexicon

September 30th-October 2nd, 2014

Niagara-on-the-Lake, Ontario

INVITED SPEAKER:
Dr. Harald Baayen
U. of Tuebingen

Hosted By: Brock University & McMaster University

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Welcome!

Dear Colleagues,

Welcome to the Ninth International Conference on the Mental Lexicon. It has now been 16 years since our first conference in Edmonton in 1998. From the outset, our goal has been to provide a forum for the exchange of new findings and perspectives on how words are represented and processed in the mind and brain.

We hope that you enjoy the historic setting of Niagara-on-the-Lake and the facilities of the Queen's Landing Hotel. Most importantly, we hope that you will have plenty of opportunity for collegial interaction. As has been our tradition, platform presentations are held in a single joint session and poster sessions constitute the backbone of research dissemination at the conference.

In this opening page, we would like to take the opportunity to thank the individuals and organizations that have made the Ninth International Conference on the Mental Lexicon possible.

The conference is hosted by McMaster University and Brock University. We are grateful for the support that we have received from the Dean of Humanities at McMaster University as well as the Vice President Research. We are also grateful for the support of the Office of the President at Brock University as well as its Conference Services Department and support group.

We would also like to express our gratitude for the hard work of the Scientific Committee. We have all benefitted greatly from the judgment, expertise and hard work of the international team consisting of Raymond Bertram (Finland), Doug Davidson (Spain), Mirjam Ernestus (The Netherlands), Robert Fiorentino (USA), Christina Gagné (Canada), Jennifer Hay (New Zealand), Juhani Järvikivi (Canada), Clint Johns (USA), Eva Kehayia (Canada), Emmanuel Keuleers (Belgium), Andrea Krott (UK), Fermín Moscoso del Prado Martín (USA), Michael Ramscar (Germany), Jay Rueckl (USA), and Lee Wurm (USA).

We would also like to take this opportunity to thank the Canadian Organizing Committee. It has been a great pleasure for us to work with Lori Buchanan (U. of Windsor), Veena Dwivedi (Brock U.), Debra Jared (Western U.), Gonia Jarema (Université de Montréal), and Chris Westbury (U. of Alberta).

The local organization has been a team effort. Our sincere thanks go to Laura Teddiman and Kaitlin Curtiss (Brock University) and Sheryl Sawyer, Richard Mah, and Kazunaga Matsuki (McMaster University).

We have benefited greatly from the generous support of our conference sponsors, SR Research and Brain Vision, as well as from support from John Benjamins Publishing.

These groups and individuals have all been extremely important in laying the foundation for a successful conference. But, of course, the most important persons are the conference presenters themselves who join with their colleagues to share insights, data, conclusions, and the newest methods that enable us to advance knowledge and break new ground in the understanding of how words are represented and processed in the mind and brain.

Thank you for your important work and enjoy the conference!

Victor Kuperman and Gary Libben

Schedule

Day 1

Time	Event
07.00 - 08.45	Breakfast & Registration
08.45 - 09.00	Welcome
09.00 - 10.00	Platform Session 1.1
10.00 - 11.00	Poster Session 1.1 & Refreshments
11.00 - 12.00	Platform Session 1.2
12.00 - 13.00	Lunch
13.00 - 14.00	Invited Address: Harald Baayen University of Tübingen
14.00 - 15.00	Poster Session 1.2 & Refreshments
15.00 - 16.20	Platform Session 1.3
16.20 - 16.40	Break
16.40 - 18.00	Platform Session 1.4

Day 2

Time	Event
07.00 - 08.55	Breakfast
09.00 - 10.00	Platform Session 2.1
10.00 - 11.00	Poster Session 2.1 & Refreshments
11.00 - 12.00	Platform Session 2.2
12.00 - 13.00	Lunch
13.00 - 14.00	Platform Session 2.3
14.00 - 15.00	Poster Session 2.2 & Refreshments
15.00 - 16.00	Platform Session 2.4
16.00 - 16.10	Break
16.10 - 17.30	Platform Session 2.5
18.30 - 22.00	Conference Banquet (transportation provided at 18.00)

Day 3

Time	Event
07.00 - 08.55	Breakfast
09.00 - 10.00	Platform Session 3.1
10.00 - 11.00	Poster Session 3.1 & Refreshments
11.00 - 12.00	Platform Session 3.2
12.00 - 13.00	Lunch
13.00 - 14.00	Platform Session 3.3
14.00 - 14.20	Closing Remarks

Keynote Address

Implicit Morphology

Dr. R. Harald Baayen, Eberhard Karls Universität Tübingen

Are form representations for words and morphemes necessary for a computational theory of lexical processing? Many models answer this question in the affirmative. Implicit morphology, by contrast, is a computational model of lexical memory, under development in the quantitative linguistics lab in Tuebingen, in which representations for words and morphemes play no role. Implicit morphology restricts itself to lexemic units (in the sense of Aronoff) and n-tuples of letters or phonemes (typically n=2 or n=3), and uses the Rescorla-Wagner discriminative learning equations to set weights on the associations between the lexemes and the n-tuples.

In this presentation, I address the segmentation problem. It is generally assumed that children (and adults) have to find word boundaries in the speech stream, and that phonotactic transitional probabilities play a central role here.

By means of a series of simulation studies, I will show that implicit morphology can learn to detect the lexemes expressed in utterances without ever having to segment or parse these utterances. Importantly, implicit morphology can be shown to outperform segmentation-based algorithms.

Understanding utterances does not guarantee correct production of these utterances. Simulation studies suggest that for accurate production, some single-lexeme utterances (which parents provide in abundance to their children) are essential. The combination of single-lexeme and multiple-lexeme utterances is sufficient for high accuracy.

Thus, the segmentation problem emerges, from the perspective of implicit morphology, as an ill-posed question. Furthermore, comprehension and production without forms for words and morphemes, and without segmentation is computationally feasible.

Dr. R Harald Baayen is regarded as one of the best and most innovative researchers in the field of vocabulary research and quantitative linguistics. He is a pioneer of computer assisted and empirical linguistic research and psycholinguistics, and has made fundamental contributions to our understanding of human speech and the role of the memory in language processing. Baayen is the Chair of Quantitative Linguistics at the University of Tübingen.

Tuesday, September 30ᵗʰ

07.00 - 08.45	Breakfast & Registration
08.45 - 09.00	Welcome
09.00 - 10.00	Platform Session 1.1
10.00 - 11.00	Poster Session 1.1 & Refreshments
11.00 - 12.00	Platform Session 1.2
12.00 - 13.00	Lunch
13.00 - 14.00	Invited Address: Harald Baayen University of Tübingen
14.00 - 15.00	Poster Session 1.2 & Refreshments
15.00 - 16.20	Platform Session 1.3
16.20 - 16.40	Break
16.40 - 18.00	Platform Session 1.4

Platform Session 1.1

09.00—09.20

Frequency and prevalence: A marriage of measures

Emmanuel Keuleers, Paweł Mandera, Michaël Stevens, Marc Brysbaert

09.20—09.40

Dissecting semantic transparency effects in derived word processing: a new perspective from distributional semantics

Marco Marelli, Marco Baroni

09.40—10:00

How useful are extrapolated measures of psycholinguistic norms?

Paweł Mandera, Emmanuel Keuleers, Marc Brysbaert

Frequency and prevalence: A marriage of measures
Emmanuel Keuleers, Paweł Mandera, Michaël Stevens, Marc Brysbaert

Word frequency is one of the most important measures in the cognitive study of word processing, both theoretically and methodologically. Its contribution in explaining behavioural measures such as reaction time is so large that researchers take great care in collecting large and reliable corpora and in applying the best possible word frequency estimates in their research.

A drawback of frequency counts is that, regardless of corpus size, lower counts are unreliable. As an example, consider asking a random sample of 100 people whether they know each of the word types that occur just once in a large corpus. Although frequency for all these types is equal, the number of judges knowing each word will likely vary from zero to one hundred and, as the judges are language users, words known to many of them may be considered to occur more often in language than words which are known by fewer of them. Following this reasoning, the estimate of *the number of language users who know a word*, or *word prevalence* may give a better indication of occurrence than corpus frequency counts.

On the other hand, consider presenting the same random sample of people with words from the language's core vocabulary. Since these words will be known to all of the judges, *prevalence* will be singularly high and uninformative. In this case corpus counts should be a much better estimate of occurrence.

To test the complementarity of prevalence and frequency as measures of occurrence, we used prevalence norms for Dutch collected through a lexical decision task presented as an online vocabulary test. Each participant saw 100 stimuli (about 70 words and 30 nonwords) selected randomly from a list of 54,319 words and 21,734 nonwords. In the current analysis, we used the data of 190,771 participants who indicated that they were living in Belgium, giving us about 250 observations per word. The difficulty score of a word obtained by fitting a Rasch model to the data was considered an operationalization of its prevalence.

We used the data from the 7,885 items in the Dutch Lexicon Project (Keuleers et al., 2010) for which both frequency and prevalence were available to examine the contributions of Dutch corpus word frequency (SUBTLEX-NL, Keuleers et al., 2011) and word prevalence on average reaction times. In single variable analyses, log word frequency explained about 36.13% of the variance in reaction times and prevalence explained about 33.03% of the variance in reaction times. The correlation between prevalence and frequency was relatively low (.34) showing that the two measures are not simple mathematical transformations. This was also made clear when both measures were considered in the same analysis, where both measures jointly explained 51.37 % of the variance in reaction times. The unique contributions (partial eta-squared) were determined to be 27.39% for frequency and 23.87% for prevalence. In further analyses, we found that including the quadratic trend of word frequency and contextual diversity did not substantially alter this pattern of results.

The results show that, after word frequency, prevalence is by far the most important independent contributor to visual word recognition times, suggesting that prevalence should be included in any analysis where corpus frequency is considered. We will present further analyses of prevalence measures in English and Spanish and consider their contribution to other behavioural measures such as word naming latencies and fixation durations.

Dissecting semantic transparency effects in derived word processing: a new perspective from distributional semantics
Marco Marelli, Marco Baroni

The present work proposes a computational model for morphological representations at the meaning level. The model moves from the tenets of distributional semantics, and assumes that word meanings can be effectively represented by vectors recording their co-occurrence with other words in a large text corpus. Given this assumption, we propose that affixes can be modelled as functions (matrices) mapping stems into derived forms, and estimated from corpus data by means of machine learning techniques. As a consequence, derived-form meanings can be thought as the result of a combinatorial procedure which transforms the stem vector on the basis of the affix matrix (e.g., the meaning of "nameless" can be obtained by multiplying the vector of "name" with the matrix of "-less").

In this framework, semantic transparency can be operationalized as the proximity between the vector associated to the word stem and the vector associated to the derived form. This latter distributional representation could be either extracted from corpus co-occurrences of the derived form treated as an independent word (*whole-word* approach) or generated through the above described data-induced compositional procedure (*composition* approach). Whereas the former measure is expected to indicate the degree of similarity between two independent meanings, the latter would capture to what extent a stem meaning is modified through the affixation process.

The two approaches do not constitute alternative explanations for the same process; rather, they appear to be models of cognitively different and behaviourally distinguishable procedures. Indeed, in a series of three experiments we observed a clear dissociation between composition- and whole-word-based representations. Composition is most predictive of lexical decision latencies and short-SOA priming effects. It can thus be described as an early, fast, data-driven procedure, that builds on automatically accessed morphemes and generates derived-word meanings on the basis of systematic semantic (sub)regularities. The whole-word-based measure is a good predictor for explicit judgments on semantic transparency and long-term priming effects. These results suggest a procedure that emerges late during word processing, capitalizes on the similarity between different meanings, captures non-systematic, unpredictable phenomena, and is at least partially based on stored lexical

knowledge.

In conclusion, the model we propose provides a new account for the relatively overlooked step of meaning (re)combination in morphological processing and constitutes a new interpretative framework for effects associated to semantic transparency in visual word processing.

How useful are extrapolated measures of psycholinguistic norms?
Paweł Mandera, Emmanuel Keuleers, Marc Brysbaert

Many important properties of words, such as age-of-acquisition (AoA), concreteness, dominance, valence and arousal, are commonly measured by collecting ratings from human judges. Because such a collection procedure is time-consuming, Bestgen & Vincze (2012) proposed that it may be useful to obtain the ratings for a limited set of seed words and extrapolate them for other words by applying statistical procedures which make use of semantic information derived from word co-occurrence patterns in text corpora. In the current study we evaluate to what extent these extrapolated ratings can be practically used as a substitute of ratings collected from human judges by putting them in a context of statistical procedures commonly applied in psycholinguistic research.

To do so, we first extrapolate ratings using three different methods (k-nearest neighbours, random forest and a dimension estimation method) based on semantic information derived from an English subtitle corpus with Latent Semantic Analysis (Landauer & Dumais, 1997), Latent Dirichlet Allocation (Blei, Ng, & Jordan, 2003) and Skip-gram word2vec (Mikolov, Chen, Corrado, & Dean, 2013). We use sets of human ratings including tens of thousands of words for AoA (Kuperman, Stadthagen-Gonzalez, & Brysbaert, 2012), concreteness (Brysbaert, Warriner & Kuperman, 2013) and affective ratings (arousal, dominance, valence; Warriner, Kuperman & Brysbaert, 2013) split into training and test sets.

Next, we evaluate the usefulness of the extrapolated ratings by calculating how much variance in the test set of the original ratings they account for. Because in psycholinguistic research variables are often dichotomized or split into multiple bins, we also evaluate how accurate classification of words into different bins would be based on the extrapolated ratings in terms of precision, recall and F1-score.

We find that, although the correlations of the extrapolated ratings with original ratings are relatively high (e.g. 0.69 for AoA, 0.77 for concreteness, 0.47 for arousal, 0.60 for dominance and 0.69 for valence when the k-nearest neighbours method used with semantic space acquired from word2vec was applied) they may be insufficient to make extrapolated ratings a practical substitute for ratings collected from human judges if the ratings are binned and used as factors in the analysis. Using the example of AoA we also show that the extrapolated ratings account only for a fraction of variance in lexical decision reaction times explained by the original ratings.

Poster Session 1.1

10.00—11.00

1. Compounding Matters: The P1 as an Index of Semantic Access to Compound Words
Charles P. Davis, Gary Libben, Sidney J. Segalowitz

2. Set for Variability Effects on Word Recognition in Skilled and Poor Developing Readers
Devin Kearns, Joanne Carlisle

3. Positioning English Derivational Affixes in the Lexicon
Samantha Gordon, Elsi Kaiser, Louis Goldstein

4. Long-lag morphological priming and picture naming: a behavioural study.
Tina Marusch, Leander Neiss, Lyndsey Nickels, Frank Burchert

5. Morphologically conditioned lengthening: A phonetic window to lexical access?
Ross Godfrey

6. Number and the Activation of Event Knowledge
Veena D. Dwivedi, Kaitlin E. Curtiss

7. What is represented in the universal quantifier: Plurality or distributivity? Evidence from ERPs

Xiaoming Jiang, Yang Zhang, Xiaolin Zhou

8. The phonetic encoding of /v/-/w/ in German-English bilinguals
Anna E. Piasecki, Ingo Plag

9. Depth of Processing Modulates the Role of Linguistic and Embodiment Factors
Simritpal K. Malhi, Lori Buchanan

10. Word Comprehension in Reading is Fast and Furious
Cyrus Shaoul, Jacolien van Rij, Harald Baayen, Petar Milin

11. The role of inflectional morphology in co-occurrence semantic representations
Alexander Johnson, Fermin Moscoso del Prado Martín

12. Defying Zipf's law
Marjolein van Egmond, Sergey Avrutin

13. A "mountain lake" is ok, but a "lake mountain" is not. A model for the generation of novel compounds based on distributional semantics.
Marco Marelli, Marco Baroni

Compounding Matters:
The P1 as an Index of Semantic Access to Compound Words
Charles P. Davis, Gary Libben, Sidney J. Segalowitz

Recent electrophysiological research has demonstrated that lexicality, word frequency, and semantic richness index lexical access sooner than once thought, as early as the P1 event-related potential (ERP) component, or approximately 100 ms post-stimulus (Segalowitz & Zheng, 2009; Zauner et al., 2014). We aimed to investigate three questions fundamental to our understanding of reading: (1) we investigated the timing of semantic access; (2) we sought to gain insight into decomposition processes involved in processing compound words; and (3) we examined the P1 ERP component, which appears to be generated by multiple underlying generators (Desjardins & Segalowitz, 2013), with respect to traditional ERP research (Dien, 2009), independent component analysis (Desjardins & Segalowitz, 2013), and traveling alpha waves (Zauner et al., 2014).

We examined the time course of compound word processing, taking advantage of the unique features of compound words to assess the timing of lexical-semantic access. Participants were 22 undergraduate students who performed a lexical decision task on 80 real compound words and 80 novel English compound words presented six times each (once in each of six blocks of trials). Forty of the real compounds were the focus of the present analyses. Compounds varied with respect to their constituent semantic transparency, i.e., the extent to which the lexical meanings of constituents were preserved in the whole compound meaning. Thus, compounds ranged from full semantic transparency (e.g. bedroom) to partial transparency (e.g., crowbar) to full opacity (e.g. hogwash). Regression analyses predicted ERP components (P1, N170, P2, P3, and N4) from compound constituent transparency, adjusting for word frequency (WF). EEG data were collected using a 128-channel EGI Hydro-Cel system.

WF predicted differences in the latency of the early left-side P1 component. WF and constituent transparency both uniquely predicted left-side P1 amplitude. Constituent transparency, but not WF, predicted amplitude of the left-side P2 and P3, and both left and right side N4. These effects were driven by the opacity of the second constituent.

The results suggest that some level of semantic access, independent of word frequency, occurs as early as the P1 component. This is a considerable deviation from traditional electrophysiological research, which has demonstrated a standard template for semantic access occurring at the N4.

Set for Variability Effects on Word Recognition in Skilled and Poor Developing Readers

Devin Kearns, Joanne Carlisle

In this study, we extended Tunmer and Chapman's (2012) work on *set for variability* (Venezky, 1999). Set for variability is the idea that phonological recoding requires the ability to identify the sounds that letters make and the ability to link the resulting *spelling pronunciation* to a lexical entry (Elbro, de Jong, Houter, & Nielsen, 2012). Tunmer and Chapman (2012) created a test to measure set for variability, in which children listened to mispronunciations of 40 English words (e.g., /wæsp/ for /wɑsp/) and said the intended word. Set for variability assessed at age 5 was found to be a powerful predictor of exception word reading at age 5 as well as exception word reading and decoding assessed at age 7. These effects were significant when controlling for phonemic awareness, syntactic awareness, context-free word recognition, and vocabulary knowledge assessed at age 5. Their results suggested that early vocabulary and phonemic awareness contributed to set for variability, which related to later decoding and word reading. Of some interest is whether set for variability relates to word reading and decoding skill after the initial years of learning to read for children with and without reading disabilities (RD).

We used Tunmer and Chapman's (2012) measure to predict the word reading and decoding skill of 8 and 9 year-old children with RD (*n* = 50) and without RD (*n* = 55) (based on TOWRE2-SW and TOWRE2-PD; RD = standard scores < 86; Torgesen, Wagner, & Rashotte, 2012). Five items in the set for variability measure were replaced to fit the American context. The research questions (RQ) were these: (1) Does set for variability relate to the children's scores on the Woodcock Reading Mastery Test, 3rd Edition (WRMT3; Woodcock, 2011) Word Identification subtest (a word reading measure), after accounting for their age, grade, phonological awareness (PA; CTOPP Elision; Wagner,

Torgesen, & Rashotte, 1999), morphological awareness (MA; Carlisle, 2000), and vocabulary size (PPVT4; Dunn & Dunn, 2005)? (2) Does set for variability relate to these children's scores on the WRMT Word Attack subtest (a decoding measure), after accounting for the same covariates? (3) Does set for variability interact with RD status?

The data were analyzed using hierarchical regressions, following Tunmer and Chapman (2012), except that we used MA instead of syntactic awareness and all of our data were collected concurrently. The following were entered before the set for variability measure: (1) age and grade, (2) PA, (3) MA, (4) decoding skill (for RQ2 only), and (5) vocabulary size. For the word identification (RQ1) and decoding (RQ2), all variables except vocabulary were significant when entered in hierarchical order. In the concurrent analysis, only decoding (β = .52) and set for variability (β = .25) predicted word identification skill, and only phonological awareness (β = .25) and set for variability (β = .40) predicted decoding skill. With regard to RQ3, RD status did not appear to interact with set for variability.

In summary, set for variability appears to affect the reading and decoding skills of 8 and 9 year-old children, extending Tunmer and Chapman's (2012) findings with 5 and 7 year-olds. English orthography's inconsistency may require a strong ability to adjust spelling pronunciations. Given that older children encounter many long words that often need more adjustments, they may continue to need set for variability to locate lexical entries with incomplete orthographic representations (Perfetti, 1992). For nonwords, set for variability may help children make the many phonological adjustments longer items require (flapping of intervocalic /t/ or /d/; vowel reduction) to produce a natural pronunciation.

Positioning English Derivational Affixes in the Lexicon

Samantha Gordon, Elsi Kaiser, Louis Goldstein

One fundamental question about the lexicon is how we produce and comprehend morphologically complex derived words like 'kindness' (kind+*ness*) or 'unknown' (*un*+known). Existing work on English derivational morphology has focused on relative ordering among affixes (e.g. *sleeplessness*, **sleepnessless*) as well as the mental representation of such complex words. However, the fundamental question of what influences whether an affix is attached to a stem *as a prefix or a suffix* is not well understood. Why does English have *un+known* but not *known+un*, or *kind+ness* but not *ness+kind* (e.g. Crepaldi, Rastle, & Davis, 2010)? We report a corpus study and an experiment that investigate some factors that may influence affix position.

Research on mental representation shows that derivations are often stored as full forms in the mental lexicon (e.g. Hay & Baayen, 2005). Other lines of inquiry show that humans are sensitive to phonotactic information about their language (e.g. segmentation in word learning, Saffran, Newport, & Aslin, 1996). In light of these findings, we wanted to test whether knowledge of phonotactic probability contributes to language users' choices

about affix attachment location (suffix/prefix). In forming and processing *novel* derived words, how do speakers know where to position an affix? Is stem attachment/positional information stored within a discrete mental representation of the 'bare' affix in the lexicon? We tested this by means of (i) corpus analyses and (ii) an experiment with English speakers using an artificial language.

Corpus study: The corpus study used CELEX to investigate English derivational affixes (from Fudge, 1984) with syllable types CV, VC, and CVC (*type count* = 88, *token count* = 12,087). We compared derivational prefixes and suffixes in terms of (1) syllable type distribution, (2) affix- edge segment identity, and (3) conditional probabilities of segment bigrams at the stem-affix boundary (prefix+stem, stem+suffix). We found there were (1) distinct distributions of syllable types in prefixes vs. suffixes (p <.00001, $\chi 2$ = 42.909). There were (2) no significant prefix/suffix differences in affix-edge segment identities. However, (3) conditional probabilities had distinct distributions (p <0.0005) in prefix+stem bigrams vs. stem+suffix bigrams.

Experiment: To test whether English speakers (*n*=24) generalize these patterns to novel words, we conducted an artificial-language study manipulating affix syllable types CV, VC, and CCV (rather than CVC to avoid overlap with actual English affixes), based on the corpus findings. Participants saw a nonce bisyllabic stem (e.g. veemper) and a nonce affix (e.g. *aug*) on a screen and indicated whether the affix should attach to the left or right of the stem. (Instructions made clear which piece was a stem and which was an affix). We manipulated (i) affix syllable type and (ii) whether the stem-edge segment was a vowel or consonant. The results show a main effect of affix syllable type ($F_1(2,46)$=9.31, p<.001), and an affix-type by stem-type interaction ($F_1(4, 92)$=3.05, p=.021), indicating a fine-grained sensitivity to stem-affix boundary phonotactics.

Conclusions: Our findings show that syllable type can help to identify derivational prefixes and suffixes. In addition, the conditional probabilities of stem-affix boundary bigrams showed significant differences for suffixes and prefixes in the corpus data. These results suggest that, in the absence of semantic/syntactic information, phonotactic information differentiates prefixes from suffixes, and affixes' positional information may be computed based on probabilistic phonotactic knowledge. Further research should investigate the status of derivational affixes' position information in the lexicon.

Long-lag morphological priming and picture naming: a behavioural study
Tina Marusch, Leander Neiss, Lyndsey Nickels, Frank Burchert

This study investigates the influence of stem changes in the German verbal paradigm on language production in healthy German speakers.

Irregularities are either caused by a stem change and/or by attaching a non-productive affix to the stem. In German, such irregularities are not predictable and cannot be captured by a rule. The question arises whether different types of inflections are processed by different cognitive mechanisms.

This question has received a lot of scientific attention in the past (Clahsen et al. 1999; Pinker & Ullman, 2002; Smolka, 2007). Evidence in this debate stems mainly from language comprehension studies and little is known about morphological priming patterns in spoken language production. If verbs are stored and processed by different cognitive mechanisms they should be affected differently by morphological priming. Yet, a morphologically related prime-target pair will also be related semantically and phonologically. This issue can be resolved by increasing the lag between prime and target (Zwitserlood et al. 2000; Koester & Schiller, 2008).

37 participants took part in the study. An experimental trial consisted of a prime word and a picture used to elicit the target verb. Word and picture were separated by 5 to 8 unrelated filler trials. Thus, participants saw either words or a picture on the screen and were asked to read aloud the words or name the picture as quickly and accurately as possible.

Results will show whether morphological priming effects can be replicated in language production and what priming effects emerge for different patterns of irregularity in present and past participle. Thus, the study informs the debate on the structure of the mental lexicon.

Morphologically conditioned lengthening: A phonetic window to lexical access?
Ross Godfrey

Several researchers (Walsh and Parker (1983), Losiewicz (1992), Frazier (2006), Sugahara and Turk (2009)) have reported an effect of morphological complexity on phonetic duration in English, such that the stem-final rhymes and consonantal morphemes of the complex words in (1a) are longer than their counterparts in the simple words in (1b).

(1) a. lacks, brewed, chews,
    b. lax, brood, choose,

There are two possible accounts for this. It could be that these words have differing surface phonological representations, which are interpreted differently by the phonetic component of the grammar (as suggested by Frazier (2006) and Sugahara and Turk (2009)), or it could be that the lengthening is simply a reflection of differing modes of lexical access, such that the more cognitively complex task (retrieving two morphemes and combining them, as opposed to retrieving only one morpheme) leads to longer duration (as suggested by Losiewicz (1992)).

I present results from an experiment, suggesting that in fact both hypotheses are correct. 12 native English speakers read a word list containing 22 pairs of homophones; each word was repeated five times, and the middle three repetitions were measured. Each homophone pair had a simple and a complex member. All complex words consisted of a root plus the -*s* morpheme (either signaling plural, for nouns, or agreement, for verbs). Importantly, half of the words were real words and half were nonce words. If morphologically conditioned lengthening results from a more complex task of lexical access, we expect this lengthening to be amplified in cases where the morphologically complex word cannot possibly be stored as a whole (i.e., for nonce words).

Taking vowel duration (e.g., the duration of [u] in crews/cruise) as the dependent variable, a mixed effects model showed that the interaction of complexity and novelty was in the direction predicted by the lexical access account, such that morphologically conditioned lengthening was greater for nonce words (coefficient estimate: 4.6 ms), but results were not statistically reliable (t = 0.78, n.s.).

Taking coda duration (e.g., the duration of [z] in *crews/cruise*) as the dependent variable, however, gives interesting results. The main effect of complexity was significant, but in the opposite direction than what has been previously reported: morphemic [z] is shorter than nonmorphemic [z] (coefficient estimate: −4.3 ms; t = −2.02, p < .05). The discrepancy with previous findings could have to do with the utterance-medial position of the tokens (if the middle three repetitions of five repetitions

of a word are treated as utterance-medial; see Song et al. 2013 for relevance of utterance position), and/or the particular codas involved (morphemic lengthening has primarily been found with morphemes preceded by voiceless stops, as in *wrapped* or *tacks*; these sorts of codas were not used in my study). Many representational/implementational accounts of pre–morpheme boundary lengthening actually implicitly predict morphemic shortening; my results thus suggest that these accounts are correct. However, the interaction of complexity and novelty approached significance, in the direction predicted by the lexical access account (coefficient estimate: 7.6 ms; *t* = 1.79, *p*<.10). Taken together with the vowel trend, it appears that nonce words may indeed show extra complexity-induced lengthening compared to real words.

This mild support for morphologically conditioned lengthening as a phonetic artifact of lexical access leads to interesting questions for models of production. In Levelt's (2001) production model, morphological complexity could lead to delays in naming (the *lexical selection* stage), but would not necessarily be expected to lead to delays when converting an articulatory score to overt speech. I thus conclude by considering ways in which such models could be reconciled with the data presented here.

Number and the Activation of Event Knowledge
Veena D. Dwivedi, Kaitlin E. Curtiss

A picture verification study was conducted using uninflected word triplets such as KID CLIMB TREE (cf., Chwilla & Kolk, 2005) in order to investigate the role that heuristic vs. algorithmic processes play in language comprehension. These words formed the N1VN2 lexical skeleton from quantifier scope ambiguous sentences such as Every kid climbed a tree. Following Chwilla & Kolk (2005) we hypothesized that the triplets alone would be interpreted as a conceptual event. In the aforementioned Event Related Potential language study, participants responded to stimuli such as VACATION TRIAL DISMISSAL with an N400 component, indicating semantic anomaly, as compared to DIRECTOR BRIBE DISMISSAL. This result shows that uninflected word triplets encourage the computation of event knowledge. In the present work, we further hypothesize that particular events have the information of number of participants (e.g., just one vs. several) associated with them. In the current study, 45 subjects were instructed to interpret word chunks such as KID CLIMB TREE as telegrams, and select a picture via button press regarding the number associated with TREE. The hypothesis was that responses to word triplets could serve as a predictor for judgments of full sentences, that is, those displaying quantifier scope ambiguity. Sentences such as Every kid climbed a tree are semantically ambiguous; since it may be inferred that either one (inverse scope interpretation) or several trees (surface scope interpretation) were climbed. This ambiguity is attributed to the algorithmic computation of quantifier scope (May, 1985; Fodor & Sag, 1982). An empirical preference has been shown, such that participants prefer the plural/surface scope interpretation (Kurtzman & MacDonald, 1993; Raffray & Pickering, 2010). However, perhaps the interpretation is not derived via algorithmic computation but instead from heuristic knowledge regarding events (Kim & Sikos, 2011; Kuperberg, 2007) and the likely number of participants in events. This hypothesis emerges from a previous norming study, discussed in our recent publication, where 32 participants judged tree in Every kid climbed a tree as plural 100% of the time, but diamond in Every jeweler appraised a diamond was judged as plural at 60%. Given that those sentences were exactly alike in terms of syntactic structure, differences in interpretation must have been due to the individual lexical items, and their contribution to a potential schema (Schank & Ableson, 1977). In the present work, a binary logistic regression analysis was conducted to test the likelihood of a plural judgment in the norming study using the current word triplet responses as a predictor. Results confirmed that the triplet judgments were reliable predictors of the sentence judgments. Implications for the on-line computation of event meaning are discussed.

What is represented in the universal quantifier: Plurality or distributivity? Evidence from ERPs
Xiaoming Jiang, Yang Zhang, Xiaolin Zhou

Using event-related potentials (ERPs), a study on Chinese has demonstrated that a universal quantifier (dou/ all) preceded by a singularized noun (quantifier mismatch: Xiaoming sewed all that button onto the clothes) elicited a larger sustained positivity on the quantifier than the one which was preceded by a pluralized noun (quantifier match: Xiaoming sewed all those buttons onto the clothes, Jiang et al., 2009). Two possible hypotheses are available to interpret the enlarged ERP effects associated with the quantifier mismatch. The grammatical repair hypothesis assumed that the universal quantifier grammatically constrains a plural-formed noun and the sustained positivity effect was associated with the resolution of the grammatical error of number agreement (Xu et al., 2013). The event computation hypothesis, however, assumed that the universal quantifier represents distributivity so that the entity (or the event) constrained by the quantifier is distributive (e.g. Buttons can be sewed onto the clothes one by one). The sustained positivity effect was thus interpreted as an effort in establishing relations between quantifiable entities and the universal quantifier in order to build a plausible eventual representation (Brouwer et al., 2007). This study aimed to dissociate the two hypotheses by manipulating both the plurality and the distributivity of the entity preceding dou. Three types of sentences were created in which the universal quantifier was either preceded by a plural and distributable (1a, quantifier match), or by a singular but distributable (1b, number mismatch: It's likely an apple can be divided into pieces and

placed into the basket), or by a singular and non-distributable entity (1c, event mismatch, see below for exemplar, It's unlikely a sesame can be divided into pieces and placed into the basket). Participants were asked to read sentences word by word and to judge the comprehensibility of each sentence. Both the number mismatch and the event mismatch elicited a larger late 550-800 ms positivity than the quantifier match condition on the quantifier. The event mismatch elicited an additional N400 effect than the number mismatch and the quantifier match condition. These findings were consistent with the distributivity account and suggested that the universal quantifier constrained an event that can be distributable (An apple can be placed into the basket piece by piece) and such mental representation was immediately used during online sentence comprehension.

The phonetic encoding of /v/-/w/ in German-English bilinguals

Anna E. Piasecki, Ingo Plag

A long-standing interest in speech science and experimental phonetics has been the acquisition of novel phonetic categories by non-native speakers. Previous research has shown that although foreign accents persist even for highly proficient speakers of a non-native language (Flege & Hillenbrand, 1987), specific training (Bradlow, Pisoni, Akahane-Yamada, & Tohkura, 1997) and extensive exposure to a target language may increase the learning of the phonetic properties of non-native speech to native-like levels (e.g. Escudero & Boersma, 2004; Flege, 1988; but see Iverson, Ekanayake, Hamann, Sennema, & Evans, 2008, for problematic issues). The objective of the research reported in this paper was to examine this acquisition process, with a particular focus on the emergence of an overproduction effect, where a newly acquired phonetic category is inserted into the wrong phonetic environment.

The study arose from the observation that native German speakers of English often display a strong non-native accent in sentences such as *A Vietnamese visitor to Wellington was worried about the very heavy wind.* A common problem when reading this sentence is these speakers' misproduction of /w/ in *wind*, which is typically exchanged with the native /v/ sound.

Another common observation is the misproduction of /v/ in *visitor*, which is erroneously pronounced as /w/, despite an existing native /v/ pronunciation in words with an initial <v> (e.g. *Vietnamese*). Employing a group of German-English bilinguals, we explored the speakers' production of the /v/-/w/ contrast in their L2, and the factors affecting these pronunciations. Participants were recorded reading an English text, which was manipulated to contain a large amount of target contrasts, such as displayed in the sentence above.

Mixed-effects regression analysis revealed that (1) the position of the target sound in the word and the previous use of the other target sound significantly influence the probability of errors, and (2) in contrast to what we found with early learners, advanced speakers exhibit as many errors with /v/ as with /w/ (and even more errors with /v/ than with /w/ in word-initial position). Models of speech production are discussed to account for the observed findings, as well as the impact of complex, cross-linguistic interactions between the sub-lexical orthographic and phonological levels on the bilinguals' performance (cf. Piasecki, 2012).

Depth of Processing Modulates the Role of Linguistic and Embodiment Factors

Simritpal K. Malhi, Lori Buchanan

According to the linguistic account, word meaning is predominantly based on the statistical frequency with which certain words co-occur (Louwerse & Jeuniaux, 2008; as cited in Louwerse & Jeuniaux, 2010). In contrast, the embodied account maintains that meaning is derived via simulated perceptual experiences (Barsalou, 1999). Louwerse and Jeuniaux (2010) found that the linguistic account may better explain word processing for quick and shallow tasks such as semantic judgments, while perceptual simulations may be needed for subsequent and deeper stages of processing. They operationalized the linguistic factor as word order frequency using the Web 1T 5-gram corpus and the embodiment factor as whether word pairs were presented in their correct spatial configuration ('monitor' above 'keyboard'). Neurological evidence also supports linguistic processes preceding perceptual simulation processes (Louwerse & Hutchinson, 2012).

Unlike word order frequency, lexical co-occurrence models of semantic neighbourhood (Durda & Buchanan, 2008) have not yet been used as a linguistic factor for contrasts with embodiment. The present study aimed to address whether a semantic neighbourhood model (WINDSORS) could replicate the results

of Louwerse and Jeuniaux (2010), and whether the role of linguistic and embodiment factors differed for concrete and abstract stimuli. Participants viewed concrete and abstract word pairs presented in the middle of a computer screen and were asked to make judgements about relatedness (semantic task) and spatial configuration (spatial task). Half of the target word pairs were shown in their correct spatial configuration and half were shown in an incorrect spatial configuration. Moreover, half of the word pairs presented in their correct and incorrect spatial configurations were close semantic neighbours and half were distant semantic neighbours. Therefore, the 4 conditions were: correct spatial-close semantic, correct spatial- distant semantic, incorrect spatial-close semantic and incorrect spatial-distant semantic.

Preliminary results indicated that the overall reaction time for the spatial task was slower than the semantic task. Consistent with previous findings, word processing on linguistic tasks, which are shallow, occurs faster than word processing on embodied tasks, which are deeper. In the spatial task, reaction times were fastest for the correct-spatial conditions. Also consistent with prior research, in deeper embodied tasks, spa-

tial configuration appears to influence reaction time more than semantic neighbourhood. Interestingly, abstract stimuli always elicited faster reaction times compared to concrete stimuli, with abstract stimuli leading to especially faster reaction times for spatial judgments. The results support using depth of processing to explain linguistic and embodied accounts of how we obtain meaning from words.

Word Comprehension in Reading is Fast and Furious
Cyrus Shaoul, Jacolien van Rij, Harald Baayen, Petar Milin

RSVP experiments (Rapid Serial Visual Presentation, e.g. Rubin and Turano, 1992) suggest that readers can comprehend texts presented at 1171 words/min (or 51ms/word), and recent commercial technologies have popularized this style of reading (e.g. Spritz Technology Inc., 2014). However, the dominant view in the morphological processing literature is that reading a complex word is a two-step process, with an early, obligatory and meaning-blind morphemic decomposition (Rastle and Davis, 2008). Some EEG researchers have concluded that semantic interpretation begins at approximately 300-500 ms post stimulus onset (but see Segalowitz and Zheng, 2009). To investigate how early in lexical processing readers can access semantic information associated with the word, we performed two experiments using an RSVP paradigm.

Study 1: Participants (n = 19) performed a masked lexical decision task with varying presentation durations (8, 17, 25, 33, 42, 50, 58, 67 ms). Stimulus words were chosen randomly from an exhaustive list of German mono- and multi-morphemic words. We used both (a) noise masks, similar to commonly used mask-character; and (b) masks made of random consonants strings. Our analyses showed that random consonant masks interfered with lexical processing: accuracy only rose above chance at exposition times greater than 60 ms, whereas standard noise masks already yielded above chance words recognition at exposition times of just 33 ms. Interestingly, our analyses also revealed significant effects of co-occurrence neighborhood density and of corpus frequency in predicting RTs of successfully recognized words: words that had denser semantic neighborhoods were recognized faster, as were words that had higher corpus frequency. Our analyses suggest that semantic effects are present very early in lexical access.

Study 2: We tested recognition of words embedded in sentences using a picture/sentence-verification task. Participants (n = 60) were asked to judge whether a word illustrated in a picture was contained in the sentence, which was presented word-by-word in a central location on the screen, at 33 ms per word. The picture either preceded or followed the sentence (within-subject blocked design). We created 4 variants of each item, manipulating the position of the word (by adding an adverbial phrase), and the congruency with the picture. We included a lexical decision task similar to Study.1 as a pre-test, using only random consonant masks to make the pre-test comparable to RSVP reading. Our analyses show that linguistic and visual context reduce the time it takes to recognize a word: Participants scored far above chance when recognizing words in the picture/sentence verification task with only a 33 ms exposition duration, but they needed double the time (more than 60 ms) for recognizing words without context in the masked LD pre-test. Accuracy was high when the picture preceded the sentence and was lower but still above chance when the picture preceded the sentence, indicating that the context effect is not solely due to a picture priming effect, but rather that the semantic information was being processed.

We conclude that lexical processing is "fast and furious", in that orthographic input triggers immediate semantic interpretation. Moreover, we found that sentential context (which is generally present during natural reading) enhances lexical semantic access during rapid presentation. If semantic access would take place only after 300ms, the backlog created during rapid reading should make fluid comprehension impossible, contrary to fact. On the other hand our results fit well with form-and-meaning and amorphous processing accounts (e.g. Feldman et al., 2012; Baayen et al., 2011).

The role of inflectional morphology in co-occurrence semantic representations
Alexander Johnson, Fermin Moscoso del Prado Martín

Considering language as a complex dynamical system is a promising new avenue in Linguistics (e.g., Hawkins & Gell Mann, 1995, Beckner et al., 2009). This approach enables the study of language at the macroscopic scale (Mandelbrot, 1957), which can unearth relationships that are difficult or impossible to understand at the level of individual constructions. Throughout their history, languages are hypothesized to alternate between periods of drift and metastable states (e.g., Dediu et al., 2013). Metastable states are periods during which a language undergoes little change. When a disturbance changes the properties of one part of the language (e.g., the morphology, the lexicon, the syntax, …), the change might push the system away from the metastable state. This is thought to cause a cas-

cade of other changes across the grammar. Linguists have often postulated such chains of changes in the history of languages (e.g., Sapir, 1921; Lightfoot, 2002). However, it remains to be explicitly shown –beyond apparent sequentiality– that changes at one level of the grammar cause changes at other levels. Here, I introduce an approach for studying linguistic change at the macroscopic scale.

I hypothesize that periods at which change is happening at a language's grammar would be detected in a higher diversity of grammatical forms at use, reflecting how the older forms coexist with the newer ones. For morphology, this diversity can be measured using the average inflectional entropy (Moscoso del Prado et al., 2004) of the words in the language. For syntax, one

can measure the grammatical entropy (Grenander, 1976; Hale, 2006) of the probabilistic context-free grammar that describes the language.

Using a large diachronic parsed corpus of Icelandic covering the time period between the XII and the XX century (Wallenberg et al., 2011), I demonstrate that changes in the morphological paradigms of the language cause (in the strict Granger sense; Granger, 1967) changes in the syntax of the language, and importantly, not the other way around (i.e., changes in syntax temporally follow changes in morphology in a statistically reliable way).

These results demonstrate how changes in the lexicon push the system away from equilibrium, leading to a necessary reorganization of other parts of a language. It provides, for the first time, direct statistical evidence for causality in cascaded linguistic change, and for the 'punctuated equilibrium' nature of languages (Dixon, 1997; Atkinson et al., 2008).

Defying Zipf's law
Marjolein van Egmond, Sergey Avrutin

Word frequencies in texts typically conform to Zipf's law, a power law p(k)~kα, where p(k) is the frequency of the kth word if words are ordered by decreasing frequency. All natural language texts are claimed to conform to this law, although its origins are still unclear (e.g. Newman, 2005). But would it be possible to create a text that does not conform to Zipf's law? And, more importantly, how would people judge such a text?

We chose to adapt an existing text, namely the first 958 words of the Dutch novel *Ik ben omringd door debielen en ik voel me goed* by Stevan Nieuwenhuis (2005). The original text conformed to Zipf's law both in all words and in lexical and grammatical words separately.

An important criterion while adapting the text was to keep it grammatical. We therefore chose to change the word frequencies of the lexical words but not the grammatical words to prevent the creation of a text with a deviant syntax. In the adapted text, the number of types per frequency class did not follow a log-linear distribution, but a normal distribution. In addition, we created a third text, in an attempt to disentangle the effects of text adaptation in general and Zipf's law. In this text, words were replaced by near synonyms and the unstressed pronouns ('ze', 'me') were changed into their stressed forms ('zij', 'mij'). The two adapted texts did not differ from the original text in terms of sentence or clause length, number of clauses or number of sentences.

Three groups of students were recruited. Each group judged one version of the text by filling out a questionnaire addressing a wide range of textual aspects. In general, the two adapted texts were judged lower on aspects such as how pleasant and natural it was, reading ease, and, surprisingly, structure. The text without Zipf's law was judged as less 'literary' and poetic than the other two texts. Finally, respondents were explicitly asked for judgments of the variation in verbs, nouns, and adverbs and adjectives, which was rated lower for the text without Zipf's law than for the original or otherwise adapted text, in line with the adaptations that were made.

From this study, we can draw two conclusions. The first is that it is indeed possible to construct a readable and grammatically correct text that does not conform to Zipf's law, at least for lexical words and to a lesser extent to all words. For a law that is claimed to apply to any natural language text of sufficient length this is no obvious outcome. The second conclusion is that readers are sensitive to this adaption: they have an unconscious intuition about Zipf's law in texts. Therefore, this finding supports the hypothesis that Zipf's law in language is a result of the organization of the human mental lexicon, and not just a statistic idiosyncrasy.

A "mountain lake" is ok, but a "lake mountain" is not.
A model for the generation of novel compounds based on distributional semantics
Marco Marelli, Marco Baroni

The generation of novel words is a fundamental human ability: not only our mind is populated by thousands of concepts, but it is also able to productively combine them in order to obtain new meanings. However, not all possible word combinations are necessarily acceptable: whereas "mountain lake" is considered meaningful, "lake mountain" is not easily assigned a meaning. In the present work we describe a new computational model for word combination in the framework of distributional semantics (e.g., LSA: Landauer & Dumais, 1997) that is aimed at predicting the acceptability of novel combinations.

In the model, word meanings are represented as vectors encoding their lexical co-occurrences in the reference corpus (e.g., the meaning of "lake" will be based on how often "lake" appears with the other words). The actual combinatorial procedure is induced following Guevara (2010): given two vectors u and v, their composed representation can be computed as c = M*u + H*v, where M and H are weight matrices estimated from corpus examples. The matrices are trained using partial least squares regression, having the vectors of the constituents as independent words ("car" and "wash", "rail" and "way") as inputs and the vectors of example compounds ("carwash", "railway") as outputs, so that the similarity between M*u + H*v and c is maximized. In other words, the matrices are defined in order to recreate the compound examples as accurately as possible. Once the weight matrices are estimated, they can be applied to any word pair in order to obtain meaning representations for unattested word combinations (i.e., novel compounds).

We generated vector representations for the novel compounds included in the database by Graves et al. (2013), for which meaningfulness ratings are available. These latter ratings are significantly predicted by quantitative properties of the compound vector representations. The larger the similarity be-

tween the compound meaning and the meanings of its constituents (measured as the cosine between the corresponding vectors), the more acceptable the novel combinations. Moreover, the less isolated the novel compound vector (that is, the closer its semantic neighbors are, as an average), the higher its perceived meaningfulness. The results indicate that the meaning of a novel compounds is more easily retrieved when the combinatorial procedure a) does not heavily modify the meanings of the original constituent and b) projects the resulting vector in densely populated areas of the semantic space.

The proposed model focuses on a data-driven combinatorial procedure that is able to generate representations for the meanings of novel compounds. Both the meanings of individual words and the combination process itself are induced from regular statistical patterns in large text corpora. The predicted representations of unattested compounds are cognitively sound, insofar their quantitative properties are in line with explicit intuitions regarding the compound meanings. The quantitative-defined representations generated by the model permit a more precise study of the processing of novel compounds, opening new possibilities in the literature on word combinations.

Morphology Dependent Letter Flexibility in Hebrew Lexical Access
Marina Oganyan, Julia Herschensohn, Richard Wright

This study builds on previous work to look at whether, in Hebrew, letter position is flexible (may prime) for non-root consonants, but not for roots. That is, it investigates whether transposing two non-root consonants will inhibit lexical access in Hebrew through a masked priming paradigm.

Background: In languages with mostly concatenative morphologies (e.g. Indo-European), words are typically composed of lexical stems and affixes that derive various word forms (e.g. car+s = plural cars). In these languages, letter position is flexible in lexical access and TL words can prime (e.g. Forster 1987 [English], Duñabeitia et al 2007 [Spanish, Basque]). Letters are activated to access the stored stem information in a mental lexicon. In direct contrast to such languages, the transposition of two root letters inhibits reading in Semitic Hebrew and Arabic (Velan & Frost [V&F] 2011, 2009, 2007; Perea et al. 2010). In Semitic languages most words are root, not stem-based, with roots typically consisting of fixed order triple consonants that fit into a pattern (e.g. the Hebrew root K.T.V. whose meaning is associated with writing can be combined with a verb pattern H-T-R1-R2-R3, yielding the word HTKTV[1], pronounced 'hitkatev', meaning 'correspond'). This morphology is argued to play a role in the non-flexibility of letter position in Semitic languages (Frost et al 2012). Specifically, the roots are proposed to be stored in the mental lexicon and must be parsed from the words for lexical access (V&F 2009).

Experiment Methods and Results: Subjects (20 native Hebrew speakers 19-46 years) performed a lexical decision task, with responses recorded using an ioLab button box. Subjects were presented with words and non-words preceded by 40ms primes masked with hash tags. Primes were either unrelated (UR) non-words, identity (ID) words primed by the same word, or words with two non-root consonants transposed (TL) (e.g. the word HTKTV with K.T.V. as the root, would be primed by THKTV with two non-root consonants transposed). The TL primes significantly reduced RT, as shown in Table 1.

Table 1. Mean reaction times across priming conditions.

	ID	TL	UR(Control)
RT	670	665	711
Priming	-41&	-46*	

*p<.05

Conclusion: Transposition of two non-root consonants yielded successful priming in contrast to the transposition of root consonants in previous experiments (V&F 2009). This finding is in line with the general non-flexibility of letter position in Semitic languages, but indicates that the inflexibility is limited to root consonants. This provides further evidence for the importance of root information in Hebrew lexical access. It also indicates potential morphological parsing to extract root information during lexical access, since leaving root information intact allows for priming to occur.

[1] In Hebrew and Arabic, most vowels are omitted from the orthography and are excluded here to represent this orthography, however they are a part of the verb pattern, i.e. particular vowels are associated with particular patterns and occur in a particular order.

The cost of bilingualism: Speed of L1 lexical retrieval affected by L2 proficiency level
Eve Higby, Georgia Caldart, Loraine K. Obler

Recent studies have reported that bilinguals are slower than monolinguals during lexical retrieval tasks when both groups perform the task in their native language (L1). This has been shown for picture naming (Ivanova & Costa, 2008; Sadat, Martin, Alario, & Costa, 2012), verbal fluency tasks (Sandoval, Gollan, Ferreira, & Salmon, 2010), and a Go/No-go task based on phonological form (Rodriguez-Fornells et al., 2005). These findings have mostly been interpreted as the result of cross-language lexical interference due to the co-activation of lexical representations from each of the bilingual's languages, necessitating the suppression of non-target lexical alternatives in favor of the target language response. Previous studies have investigated this phenomenon using highly proficient bilinguals who learned both languages in early childhood. It is unknown whether these effects are limited to highly proficient, balanced bilinguals, or whether they extend to late learners of an L2 who do not have equal proficiency in both languages, which would suggest a general effect of bilingualism on lexical retrieval processes.

We tested native speakers of Brazilian Portuguese who were studying English in New York. Pilot data includes 10 participants aged 23-36 (mean 27.4, SD 4.03), who had been studying in the U.S. for on average 3.6 months (range 0.5 – 18 mos.). They reported starting to study English at a mean age of 12.8 (range 3 – 27 yrs.) with current L2 proficiency between Intermediate-Advanced. Speed of lexical retrieval in the L1 was measured using a picture naming task consisting of 140 black and white line drawings of objects with high and low frequency names. Participants' English proficiency was assessed using five proficiency measures: 1) mean self-ratings of six aspects of language (reading, listening, speaking, writing, vocabulary, and grammar), 2) current English level at their language school, 3) mean score on a Can-Do questionnaire containing 18 questions covering a variety of everyday language tasks, 4) the grammar portion of the Michigan Test of English Language Proficiency (MTELP), an auditory-based test of grammatical knowledge with 45 questions, and 5) a vocabulary test of the same 140 pictures presented during the lexical retrieval test.

Scores on the proficiency measures did not all correlate with each other. Can-Do scores correlated significantly with all other measures, suggesting it is a more global measure of general language proficiency than the others. Self-Ratings correlated with School level (r = .929, p < .001) and Can-Do scores (r = .825, p < .01), but not Vocabulary or MTELP. Next, we investigated the relationship between the proficiency measures and L1 naming performance. Scores on the English Vocabulary test correlated significantly with naming accuracy (r = .669, p < .05), indicating that participants with larger English vocabularies named pictures in the L1 more accurately. When analyzing cognate and non-cognate words separately, Can-Do scores (r = .654, p < .05) and English Vocabulary scores (r = .740, p < .05) were significantly correlated with naming accuracy for Non-cognates, but not for Cognates. None of the proficiency measures correlated with response times for naming. Nonetheless, a linear regression showed that MTELP significantly predicted response times on the lexical retrieval task (p < .05) and Self-Rating scores showed a trend toward significance (p = .06).

The preliminary data suggest that L2 proficiency does have an impact on speed and accuracy of lexical retrieval in the L1 in our group of unbalanced, late L2 learners, which may have different impacts on cognate and non-cognate retrieval. The results of the regression analysis provide tentative support for the hypothesis that lexical retrieval speed in the L1 is influenced by L2 proficiency even for unbalanced, late bilinguals.

"What is Concrete and Abstract and Read All Over!?": An fMRI Study of Polysemy

Yuan Tao, Andrew Anderson, Massimo Poesio

In this study we used functional Magnetic Resonance Imaging (fMRI) to examine the neural representation of an archetypal kind of polysemous words, "informational print matter" e.g. *book*, whose behaviours have been intensively studied in Linguistics. Such words are considered as polysemous because they refer to a physical object in some contexts (e.g. *a heavy book*), and to abstract information in some other contexts (e.g. *John does not agree with the book*) (Pustejovsky 1995, 2011; Jackendoff, 1997).

The neural representation of word meaning is a central topic of concept representation. During the last few decades functional Magnetic Resonance Imaging (fMRI) has been widely used and has shed much light on this topic. For instance it has been shown that neural activity patterns associated with viewing concrete nouns can be reliably identified and linked to the object properties and functions (e.g. Binder et al., 2009; Mitchell et al., 2008; Just et al., 2010). However, despite most words in natural language having multiple but related meanings, polysemy has thus far been made peripheral in studies of neural representation of words.

In the current experiment we looked into this issue with fMRI, examining the neural activities associated with processing an archetypal class of polysemous words. Five nouns that refer to "informational print matter" were selected (*book, magazine, catalogue, sketch, diary*), and adjectives were used as contexts to coerce them into either the concrete object sense or the information sense (e.g. *worn book* and *scientific book*), which we referred to as the complex contrast. Additionally a simple contrast was constructed as a comparison using two unambiguous categories, FURNITURE and INFORMATION (e.g. *desk* and *story* respectively) to approximate the corresponding partial senses.

Eight subjects participated in the fMRI experiment in which they were presented with the written words and performed a semantic decision task. We applied Multivariate Pattern Analysis (MVPA) to analyze the neural activity patterns. Specifically the whole cerebral cortex was divided into 96 Region-Of-Interest (ROIs), and a Support Vector Machine classifier was applied within each ROI to distinguish the two categories in each contrast. The results demonstrated that there was no overlapping region for the two contrast. The simple contrast (FURNITURE v.s. INFORMATION) showed a left-hemisphere dominance, and the two categories were most distinguishable in the bilateral precuneus. This result was in agreement with previous findings of the neural distinction between concrete and abstract concepts. Meanwhile the complex (coercion) contrast recruited regions across the bilateral posterior inferior temporal gyrus, which has been associated with high level visual features, object representation, and less reported in studies using written text. These results suggest that the neural representation of the coerced *dot-object* concepts is more complex than simply representing the partial sense, highlighting the importance of contextual influence in future studies of language processing and concept representation.

Word and root representations in the spontaneous production of regularly inflected words

Naomi Caselli, Ariel Cohen-Goldberg

There is an asymmetry in the literature regarding the status of whole-word representations in perception and production. While there is extensive evidence for the involvement of both whole-word and root representations in visual word recognition (see, Amenta & Crepaldi 2012 for a review), far less evidence exists for whole-word representations in spoken production. Indeed, the major theories of spoken production adopt a compositional approach to morphological production (Dell, 1986; Levelt, Roelofs & Meyer, 1999). In this study we examined whether there is evidence for morpheme-based representations, whole-word representations, or both in spontaneous American English speech.

To do so, we capitalized on the finding that in monomorphemic words lexical frequency is correlated with phonetic duration, with higher frequency words tending to have shorter durations (e.g., Gahl, Yao, & Johnson, 2012). We analyzed the Buckeye corpus of spontaneous speech and found that whole-word and root frequency independently predict the duration of words suffixed with *–ing, –ed,* and *–s,* even when numerous factors are controlled. Both root and word frequency correlated with shorter duration. This indicates that both root and word representations play a role in the production of inflected English words.

Because frequency effects could arise at several levels of processing, we conducted a second analysis in order to asses the locus of the frequency effects. Research on monomorphemic words has shown that neighborhood density is correlated with phonetic duration, with high-density words tending to have shorter durations than low-density words (Gahl, Yao & Johnson, 2012). For this analysis, we extracted the set of monomorphemic CVC words contained in the Buckeye corpus. For each word, we calculated both monomorphemic neighborhood density and inflected neighborhood density—that is, the number of inflected words that differ from the target by one phoneme. We found that both monomorphemic and *inflected neighborhood density* significantly influenced the duration of monomorphemic CVC words, though the effects went in opposite directions. While greater monomorphemic density led to shorter durations, greater inflected density led to longer durations. These results suggest that whole-word representations exist at same level of processing that leads to neighborhood effects, most likely a pre-phonological lexical level.

Together, these findings indicate that morpheme-based and whole-word representations are stored for inflected words in production and that these representations exist at lexical levels. The evidence is particularly compelling given that we examined inflected English words, which are thought to be *less* likely to have whole-word representations than derived words (e.g., Stanners, Neiser, & Painton, 1979). Finally, we discuss reasons why monomorphemic and inflected neighborhood density may have opposite effects on phonetic duration.

The Functional Phonological unit in Second Language Learners

Chuchu Li, Min Wang

The functional phonological unit refers to the first selectable phonological unit under the word level, and its function is to constrain phonological retrieval and encoding and finally guide the planning of spoken word production. Previous literature suggested that the functional phonological unit differs across languages (Kureta, et al., 2006; O'Seaghdha, et al., 2010). The current project investigated whether the functional phonological unit in the first language (L1) influences the unit selected in second language (L2).

Using the form preparation paradigm, previous literature suggested that the functional phonological unit is phoneme in English but it is syllable segment in Chinese (O'Seaghdha, et al., 2010). In O'Seaghdha et al. (2010), native English and Chinese speakers were asked to memorize prompt-response word pairs in their native language. In a subsequent recall task, the prompts were presented and participants were asked to say the corresponding response words as fast as possible. The response words may share the same onset or have nothing systematically in common (i.e., be heterogeneous). Compared with the heterogeneous list, native English speakers' naming latency was significantly faster in the same onset condition but native Chinese speakers did not benefit from the shared onset unit. However, native Chinese speakers showed significant facilitation when the response words share the same initial syllable segment.

No previous literature has investigated whether the functional phonological unit in L2 is influenced by speakers' L1, and the present project aimed to fill this gap. Chinese speakers who study English as a second language (Chinese ESLs) and English monolinguals were recruited in two spoken word production tasks using the form preparation paradigm. In order to avoid the influence of explicitly presented orthographic information, pictures instead of words were used as stimuli. In a simple picture naming task (Experiment 1), participants named lists of pictures as quickly as possible. The names of the pictures may share the same onset, or same rhyme, or be heterogeneous. In a memorization-recall task (Experiment 2), participants studied prompt and response picture pairs, then named the response picture when the prompt pictures unpredictably appeared. The response pictures may share the same onset or same rhyme, or be heterogeneous.

In the simple picture naming task, both groups showed significant onset facilitation and rhyme inhibition compared to the heterogeneous condition, suggesting that both groups planned onsets and rhymes separately in spoken word production in English. However, the effect size of onset facilitation in the monolingual group was significantly larger than that in Chinese ESLs. In the memorization-recall task, both groups showed significant onset facilitation and rhyme inhibition, but the two language groups showed similar effect size.

Similar to monolingual English speakers, Chinese ESLs also

choose phoneme onset as the functional phonological unit in English. This result suggested that the functional phonological unit is driven by the target language and has limited influence from speakers' prior language experience. However, native English speakers may have better phonological processing ability at phoneme level, so that they have greater onset facilitation.

Task demands may influence the effect size. Demanding tasks (e.g., the memorization-recall task) requires more cognitive resources, thus may reduce the salience of the difference between native English and ESL speakers in terms of their preference of the functional phonological unit.

The English dative alternation: evidence from first language acquisition
Daniel Bürkle

This study investigates the acquisition of the English dative alternation, which is the availability of two distinct constructions for many ditransitive verbs (cf. Gropen et al. 1989): the double object construction (1) and the prepositional construction (2).

(1) Rick gave Kate a coffee.
(2) Rick gave a coffee to Kate.

Corpus studies by Wasow (2002) and Bresnan et al. (2007) suggest that short objects precede long ones, animate objects precede inanimate ones, and plural objects precede singular ones. Their approach therefore sees the dative alternation as a choice between two ways of ordering the two objects that is guided by more general ordering principles.

Since the dative alternation is a complex system in this view, it provides a great opportunity for insights into the cognitive process of language acquisition. The only existing acquisitional study within this approach, de Marneffe et al. (2012), is based on corpus data. Their findings indicate that children's use of the dative alternation constructions can be viewed as a choice between orderings as well, and that this choice is driven by the same factors as it is in adults. It is merely the relative strengths

of some of the effects that differ. However, due to the limitations of corpus data, de Marneffe et al. (2012) were not able to establish whether animacy has an effect in children's dative alternation choice.

The present paper expands on that work with experimental results from children aged four to eight. The experiment consisted of two tasks designed to investigate how the effects of word length, animacy, and number on the dative alternation choice with the verb *give* develop in that time. The first task used eye-tracking with an interactive visual-world paradigm presented on a touchscreen computer to measure the expectations/biases in the processing of dative sentences. In the second task, participants were presented with drawings of simple scenes and pre-recorded *give* sentences describing these scenes, and were asked to repeat the sentences. Some of these sentences were presented in the double object frame, but with object combinations that are predicted to favor the prepositional construction, and vice-versa. The elicited repetitions were used to measure the relative difficulty of these counterpredicted orderings. I discuss the new insights into the acquisition of the dative alternation that these data provide, as well as the usefulness of touchscreen input as an attention-measure.

The time-course of lexical-semantic and grammatical processing in native and non-native speakers of German: an ERP study
Sina Bosch, Helena Trompelt, Alina Leminen, Harald Clahsen

The question of how and when different sources of linguistic information are used during online language comprehension has received much attention in psycholinguistic research. While serial models assume a distinct initial stage of language comprehension that is only affected by structural (form-level) information, parallel models are less constrained and assume that the language processor considers numerous sources of both structural and non-structural information simultaneously at any given point in time. The current study employed the cross-modal ERP priming technique to examine the temporal sequencing of morphosyntactic feature access relative to lexical-semantic retrieval. Our test case were inflected forms of German adjectives such as *geheim* 'secret' which are marked for case, gender, and number, with portmanteau affixes such as *-e, -s*, and *-m* (e.g. *geheim-e, geheim-es, geheim-em*). The *-m* affix is the most specific one as it is restricted to datives ([+DAT]), followed by *–s* and *-e* which occur in both nominative and accusative case.

Two ERP priming experiments were performed. Experiment 1 tested effects of lexical-semantic relatedness comparing a

test condition of morphologically related forms (e.g. *neutrales - neutral*) to identical repetition priming (e.g. neutral - neutral) and unrelated controls (e.g. *verbal - neutral*). Experiment 2 examined priming effects between different inflected forms of the same adjectives (e.g. *geheimes - geheime, geheimem - geheime*) relative to controls with identical primes and targets (e.g. *geheime - geheime*). ERP data were analyzed in an early and a late time window. Data from 54 participants were examined, 24 adult native (L1) speakers of German (mean age: 24,0) and 30 highly proficient adult second language (L2) learners of German with Russian as L1 (mean age: 25;2; AoA of German: 14;8; CEFR level of German: C1 or above). The control data were reported by Leminen & Clahsen (2014). Here we present the L2 data.

The results of these experiments revealed clearly distinct brain potentials for the two phenomena: (i) Semantically related prime-target pairs yielded a reduced centro-parietal negativity signaling facilitation in lexical retrieval. (ii) Morphologically prime-target pairs yielded a reduced positivity for *-s* and identity primes relative to primes with *-m*, reflecting the specificity of the -m affix. While for German native speakers there was an

early reduced positivity for (ii) in the 200-300ms time window and a reduced negativity for (i) with a maximum 300-400ms post onset, the L2 group revealed both ERP components in both the early *and* the late time windows.

Taken together, neither serial nor parallel models of language processing provide a full account of these data. While the L1 data indicate a temporal priority of grammatical information during processing, late bilinguals do not show any such preference, but instead rely on grammatical and lexical-semantic information in parallel.

Miscues in L2 Reading Reflect the Interaction Between Visual Word Recognition Processes and the Architecture of the Mental Lexicon

Rena Helms-Park, Joshua Pratt, Vedran Dronjic, Qiuyan Yan

Miscues are errors made when reading aloud. In the case of expert readers, most word recognition can be characterized as the simultaneous automatic activation of the phonological and semantic aspects of a lexical item upon viewing the orthographic (visual) stimulus. This perspective can be accommodated by a single route (e.g., Frost, 2005) or two competing routes (e.g., Ehri, 2005). However, automaticity does not characterize most word recognition among those learning to read, whether in an L1 or an L2, except for a subset of "sight" words involving "visuo-semantic" rather than "visuo-phonological" recognition. L1 English learner miscues produced by skilled learners generally reflect more contextually acceptable (i.e., semantically appropriate) miscues (e.g., *child* instead of *baby*) than grapho-phonological errors, which are common among poor readers (e.g., *here* for *hair*, or *girl* for *good*) (Zhang, 1988). Furthermore, native speakers' speech errors rarely involve word class (Fromkin, 1973). L2 miscue research has been meagre, mostly focusing on broad differences between word recognition strategies in the L1 and L2. The work being presented here is a preliminary exploration of how cross-script research might reveal differences not only in word recognition strategies among readers of different scripts but also the network organization and activation patterns of the L2 lexicon.

Study 1 examined only one sample group consisting of 30 undergraduate Chinese speakers at a Chinese university, taking an Academic English course. Each participant read aloud an expository text (1369 words) on mice and genetics. Miscues identified in the recording of the reading were coded by two raters. We examined only items that were more "lexical" on the lexicality cline: content words/fixed phrases, derivational morphology, and irregular (lexicalized) past tense forms (Carter, 2012). The results yielded only a few semantically related miscues (e.g., paradigmatic associations such as synonymy or antonymy), for instance, *environment* for *surroundings*. Around 20% of miscues involved word class, usually due to derivational suffixes (e.g., *convention* for *conventionally*). A vast proportion of miscues were graphically/visually similar to their targets, but with little semantic connectedness. Many had similar outlines or silhouettes (*perceived* for *preserved*), or indicated incomplete recognition (e.g., only sharing the beginning, as in *born* for *bored* or word edges, as in *include* for *induce*. The replacements were usually higher frequency words (e.g., *rare* for verbal *rear*). These miscues point towards less well-established and less complex L2 lexical networks (Wolter, 2001).

One interpretation of Study 1 results is that the visual system predominates in word recognition because the default "grain" in Chinese is the syllable (and most often also morpheme), represented by a character, which is a more abstract version of a pictogram. However, since Study 1 could not unambiguously distinguish between language-specific (i.e., Chinese) miscues and language-neutral ones, Study 2 was set up to compare the miscues of Chinese, Korean, and native English speakers (as the control) using the same expository text as in Study 1. The research questions centre on the roles of morphosyllabic versus phonographic L1 scripts (i.e., Chinese *hanzi* versus Korean *hangul*), language- specific structural issues (e.g., the scarcity of derivational morphology in Chinese); and L2 proficiency. We hypothesize that the miscues of native English speakers will be mostly conceptually generated through lemmatic connections, resulting in miscues that are related to the target word in terms of meaning and word class; only a small percentage of native-speaker miscues are expected to be only graphically related to their targets. Screening materials consist of a working memory and lexical size test. The data collected thus far suggests that (i) Chinese speakers produce more miscues related to irregular morphology, word class, and word silhouettes than their Korean or English-speaking counterparts; and (ii) both the Chinese and Korean speakers have more graphically/phonologically related (but semantically inappropriate) miscues than the English speakers. We expect that the final results will provide a window on how word recognition skills and word associations in the mental lexicon interact to activate miscue items.

How do native and non-native listeners perceive French reduced speech?

Sophie Brand, Mirjam Ernestus

In everyday conversations, words are often pronounced less clearly than in more formal speaking styles. For instance, in French words like *semaine* 'week' the first vowel is often absent. French words differ in how often they occur in a certain pronunciation variant. The word *semaine* is more often pronounced in a reduced form than the word *rebelle* 'rebel'. Little is known about how these variants are perceived. In this study we investigated whether native and non-native listeners rely on lexical representations for the reduced variants during perception.

We conducted an auditory lexical decision task that contained, among many filler words, 44 French words produced either with or without schwa. After the lexical decision task, participants indicated the relative frequencies of the two pronunciation variants for each word (e.g. *la semaine* versus *la s'maine*) by choosing a value on a scale of one to six. If the two tasks show that listeners are sensitive to the frequencies of the

different variants, this would support the hypothesis that these variants are stored in the mental lexicon and used in perception.

First, we tested 36 French native listeners from Paris. We examined the validity of their frequency estimations by comparing the ratings averaged over listeners to similar ratings obtained by Racine (2008), which correlated well with the frequencies of the variants in a corpus of spoken French. Our ratings correlated well with Racine's participants' ratings (r = 0.79). The results of the lexical decision task show that French native listeners reacted faster to reduced and unreduced variants with higher relative frequencies. These data strongly suggest that native listeners rely on lexical representations of reduced pronunciation variants during perception.

We then tested Dutch learners of French, both *beginning* and *highly proficient* learners of French. The 47 *beginning* learners of French provided ratings that do not correlate with Racine's participants' ratings. Furthermore, their response latencies in

the lexical decision experiment did not correlate with their own frequency ratings nor with the natives' ratings. In contrast, the 47 *highly proficient* learners' ratings correlated well with the ratings obtained by Racine (r = 0.46). Their response latencies in the lexical decision task correlated with their own ratings, but not with the French natives' ratings. These data strongly suggest that beginning learners do not rely on lexical representations of reduced variants, whereas the *highly proficient* learners do. The latter, however, store frequency counts that are not identical to those of the native listeners.

In conclusion, our data show that reduction processes, such as schwa deletion, may lead to lexical representations for reduced variants that are used during perception. Moreover, the results suggest that learners either do not have these representations at all or do not store them together with native-like frequency counts. This may explain why they have difficulties understanding everyday conversations in French.

The pre-lexicon: the coding of vowel contrasts in the midbrain input to the cortex
Joyce McDonough, Laurel Carney

An essential aspect of a discussion of the mental lexicon is the nature of the signal that the cortex receives from the lower auditory system. This study of the coding of vowels in the midbrain combines phonetics, physiology and modeling (Zilany et al 2014; Nelson & Carney 2004). Vowel contrasts were chosen for three reasons: 1) vowels carry rich information important to lexical representations including pitch, meter & stress; 2) vowel spaces in linguistic systems have strong cross-linguistic generalities and consistent asymmetries (Lilenjcrants & Lindblom 1972; Klatt 1982; Lindblom 1990, 1986; de Boer 2000; Schwartz et al 1997a,b; Becker-Kristal 2006; Dielh & Lindblom, 2004; De-ilh et al 2003); 3) studies exist that model the responses of the auditory nerve, but not the neural signal beyond that point. Understanding the nature of that signal will help disambiguate the information received by the cortex, and the integration of articulatory versus acoustic information, in the representation of word forms in the lexicon (Browman & Goldstein 1990, 2000; Ghosh et al 2011; Poppel & Monahan 2008; Luo et al 2013). Our goal is to extend our knowledge of the neural representations of the lexical representation of the vowel space using realistic computational models of auditory-nerve and midbrain neurons. Crucially, the representation of formant frequencies differs between the auditory nerve (AN) and the midbrain (Inferior Colliculus, IC). IC cells are tuned to temporal fluctuations on their inputs which vary across the neural population for different vowels. (*Figure left*) model IC responses for 20 speakers of 4 vowels from the Hillenbrand (1995) dataset, based on interac-

tions of excitatory and inhibitory signals, show that acoustical variability associated with vowel contrasts is maintained in the neural vowel space (arpabet symbols). Frequency ranges for F1 and F2 are highlighted in red and blue. In particular, our results support a version of Dispersion-Focalization Theory (Schwartz 1997; Becker-Kristal 2010).

This works emphasizes the importance of modeling the mechanisms that code information that form the basis of speech perception and the auditory input to lexical representations, lexical storage and access.
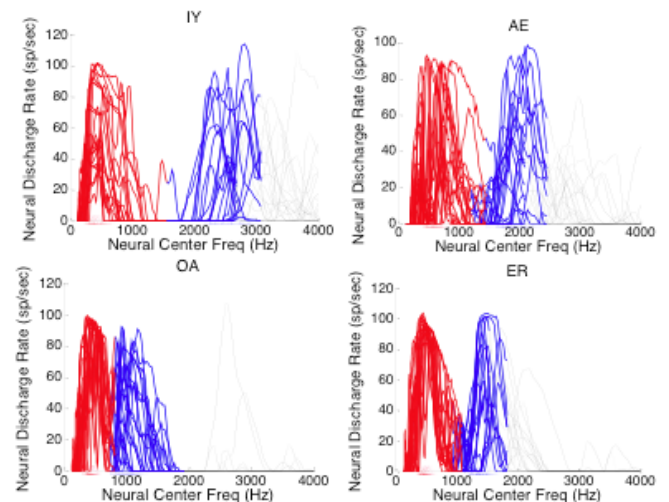
Processing French Verb-Noun Compounds
Lisa Rosenfelt, Frederic Isel, Bernard Fradin

Introduction : How are compound words stored and accessed in the lexicon? To answer this question 3 types of models: (1) a full list model, compounds are fully stored in the lexicon, (2) a full parse model, morphemes are stored in lexicon and

combined to form compounds ; compound processing involves automatic decomposition into these morpheme constituents, (3) a dual-route model, compounds are either accessed in full form or decomposed into morphological constituents. Studies

supporting a dual-route model have provided evidence of decomposition in compound processing, while showing that certain factors, such as frequency, transparency, and prosody determine whether a compound is accessed in full or decomposed. Such studies have looked at the processing of noun-noun compounds in mostly Germanic languages, measuring the response time (RT) in a priming study with a lexical decision task.

Q 1 : In the current study we first ask if there is evidence of decomposition for the processing of a different type of compound, verb-noun compounds (VNCs) in French. Q2 : We also sought to provide further evidence in favor of a dual-route model, by investigating whether varying the lexical frequency (high vs. low) of the VNC prime would affect the occurrence of decomposition.

Methods : To answer both questions we performed a repetition priming study with a lexical decision task, using ERP, instead of RT, to determine the presence of a priming effect, as would be seen via a decrease in N400 amplitude to repeated and primed items.

Stimuli : In all trials a VNC auditory prime (related/unrelated, HF/LF) is followed by a visual target (T1/T2/T3), as outlined in the table below.

Materials : 30 prime/target pairs for each of the 12 conditions, controlled for length, opacity, and family size, and180 filler VNC/pseudoword target pairs were dispersed across lists in a latin squares design, so that each participant saw a prime and target only once.

Analysis : ERP responses elicited by targets related to their primes were compared to those of the corresponding unrelated target.

Preliminary Results revealed a) a decrease in N400 amplitude to Related T3 as compared to Unrelated T3, confirming the presence of the well documented effect for the repetition of a prime ; b) a priming effect (decrease in N400 amplitude) to Related T1 and T2 compared to their Unrelated counterparts. This result provides clear evidence of decomposition, as the priming effect on a constituent target would only be seen if the constituent was accessed in the processing of the VNC prime; c) these preliminary results could not yet shed light on the comparison of high vs. low frequency primes. Results showing that LF VNCs are decomposed while HF VNCs are not would provide evidence in favor of a dual route model.

Condition	Prime	T1	T2	T3
Related HF	pare-brise	*pare*	brise	<u>pare-brise</u>
Unrelated HF	chausse-pied	*pare*	brise	<u>pare-brise</u>
Related LF	pare-neige	**pare**	neige	**<u>pare-neige</u>**
Unrelated LF	guide-fil	**pare**	neige	**<u>pare-neige</u>**

Effects of producing and perceiving a foreign accent on subsequent comprehension

Ann-Kathrin Grohe, Andrea Weber

Speech from L2 talkers typically deviates from the standard pronunciation of a target language, i.e. it is foreign-accented. We know that listeners can rapidly adapt to this variation (e.g., Clarke

& Garret, 2004), and specifically in our L2, speech from L2 talkers who match our native language background can be as easy to comprehend as speech from native talkers of that language (e.g., Bent & Bradlow, 2003). Why is it that we can easily understand L2 speech matching our own foreign accent? Does this effect mainly stem from listening to other L2 talkers with the same accent or is it rather driven by our own production of L2 speech? Using an exposure-test paradigm, we investigated this question for German learners of English by comparing the effect of accent production with that of accent perception on subsequent accent comprehension.

For exposure and test, we replaced all dental fricatives in our English materials with /t/ (e.g., /θ/ink became /t/ink). Substitutions with /t/ were chosen because they constitute a clear minority in German-accented English in comparison to the preferred substitute /s/ (see e.g., Hanulíková & Weber, 2012), and it can therefore be assumed that our German participants had not heard /t/ substitutes exceedingly often from other German talkers prior to our study. Furthermore, /t/ is perceptually not very confusable with the interdental fricatives which ensured that the substitutions were noticeable. During exposure, 48 German learners of English either listened for 10 minutes to an

English story read by a German L2 speaker who substituted all interdental fricatives with /t/ (comprehension group), or they themselves read the same story out loud with the instruction to produce the /t/ substitutes (production group). A control group of 24 German learners of English had no exposure phase. Next, each group performed an auditory lexical decision task in which all initial /θ/'s were replaced with /t/ in the critical words. Half of the critical words had been presented during the exposure (old items) and half had not been presented before (new items). The speaker for the lexical decision task was a different speaker from the speaker of the comprehension exposure. A difference in rate and speed of word judgments after exposure was taken as indication for an adjustment to the accent (see Maye, Aslin & Tanenhaus, 2008).

Reaction time analyses of items that were accepted as words revealed faster responses to old items than to new items, both for the comprehension group and the production group with no significant difference between the two exposure groups. Interestingly, endorsement rates showed that the comprehension group accepted considerably more items with t-substitutes as words (62.97%) than the production group (46.44%), with the endorsement rate of the control group being intermediate (54.15%). This pattern held for old and new items. The difference in patterns for reaction times and endorsement rates and their theoretical implications will be discussed.

Ambiguity in the Mental Lexicon: Homonymy versus Polysemy in Mandarin Chinese
Pei-Shu Tsai

Previous psycholinguistic studies for the past thirty years have suggested that in our mental dictionary, an ambiguous lexical item with unrelated meanings such as a homonymous word (e.g., *bank* in English) possesses one lexical representation with at least two distinct semantic representations. In contrast to the well-established models on homonymous words, reports on the processing of ambiguous lexical items with multiple related senses such as a polysemous word (e.g., *paper* in English) are still inconclusive. Some studies showed that people categorize polysemous words similarly to how they categorize homonymous words (Klein & Murphy, 2001, 2002); other studies displayed dissimilar patterns between these two types of ambiguous words (Beretta et al., 2005; Klepousnioto, 2002; Klepousniotou & Baum,2007; Pylkkanen et al., 2006).

The present study designed two experiments that aimed to investigate the mental representation of polysemous words in comparison with that of homonymous words. Experiment 1 presented a homonymous word (e.g., *huangniu* 'calf', meaning an animal or a scalper in Chinese) or a polysemous word (.e.g., *paodao* 'runway', referring to a physical track in the playground or an abstract direction of career in Chinese) as the final target word in a triplet (e.g.,*gengtian-maipiao-huangniu* 'tilling-selling tickets-*huangniu*' in Chinese, a design similar to *game-dance-ball* in English). The dominate, secondary, or both meanings were primed. Half of the targets were homonymous, and the other half were polysemous. The participants judged whether the target (i.e., the third word in the triplet) was related to either one of the primes on a trial. By comparing the priming patterns for polysemous targets with those for homonymous targets, the present study indicated that the representation of polysemous words in our mental lexicon was similar to that of homonymous words, in that both types of ambiguous items received additive priming effects.

In Experiment 2, either a homonymous or a polysemous target was preceded by an auditory sentential context in a cross-modal sentence-primed lexical decision task. For example, the participant heard a sentence ended with a homonymous word *nongfu ganxie zai tianli xinku gongzuo de huangniu* 'the farmer appreciated in the field the hard-working *huangniu.*' After an SOA of 1500 ms, a word that was related to the homonym's dominant meaning *gengtian* 'tilling', the subordinate meaning *maipiao* 'selling ticket', or a unrelated meaning *tiaowu* 'dancing' was visually presented. The priming patterns were again examined and compared between homonymous and polysemous conditions. Pilot results suggested that the difference between homonymous and polysemous words could be revealed. The results implied that for homonymous words, the subordinate meaning will soon be depressed, while for polysemous words, both senses were still activated because the primary and subordinate senses were related.

The results indicated that senses possessed distinct semantic representations similarly to homonymous meanings did, and the relatedness among the senses sustained the activation for a long SOA of 1500 ms. This study offered data from Chinese and shall shed some light on the long debated issue of whether polysemous words were represented differently from homonymous words in our mental dictionary.

A new measure of lexical competence: the Verb Subordinates Test
Aleka Akoyunoglou Blackwell, Jennifer Cooper, Jwa Kim

This study provides validity evidence for a new vocabulary measure of native speaker receptive vocabulary knowledge. The vocabulary measure is a Verb Subordinates Test. The test items are all true/false statements seven words in length. Each item has the syntactic structure To verbx is a way to verby (e.g., To rasp is a way to talk. To slurp is a way to talk.). All items rely on the hypernym/troponym semantic relationship between semantically superordinate and subordinate verbs in Wordnet (Fellbaum, 1998). Only troponyms with at most two senses in Wordnet were selected, and hypernyms are all highly frequent verbs (e.g., move, ask, talk, look, walk).

The test consists of four frequency levels, each represented by 8 items, with troponyms in each frequency level representing decreasing frequency. Frequency levels were determined based on the frequency rank of verbs in the 60K list of lemmas in the Corpus of Contemporary American English (COCA) (Davies, 2011). The first frequency band includes troponyms ranked within the top 7,500 lemmas (devour, jog, roast, chant, bounce, sip, chop, hop); the second frequency band consists of troponyms in the range of 18K and 23K (trundle, core, beseech, wend, lope, guzzle, rasp, slurp); the third frequency band is within the range of 30K to 45K (burgeon, jounce, hanker, flub, quaff, dodder, snivel, swill); and the fourth frequency band consists of troponyms less frequent than the top 60K lemmas in COCA (reave, prate, gawp, saltate, lollop, piffle, pronk, scarper).

Native English-speaking college students (N=304, Age, Min=18, Max=41, Mode=19, Mdn=19, M=20.63, SD=3.44) participated in the study. The task was administered on a computer with the software E-Prime which recorded response latency for each item. Test items appeared in a randomized order, individually, and centered on a computer screen and participants' response latency was recorded. After each item response, participants reported how confident they felt about the accuracy of their answer on a scale of 1 to 5.

Convergent validity was established by comparing scores on the VST to scores on the PPVT-III (Dunn & Dunn, 1997) and the Word Associates Test (Read, 1998). Significant positive correlations of scores between the VST and the PPVT-III (r = .498, p < .05) and the WAT (r = .455, p < .05) provide evidence of convergent validity. Significant negative correlations between response latency and item difficulty provide evidence of construct validity.

We discuss assumptions and implications, including results of item analyses and progress on additional item development.

Development of Meanings or Internal Representations Associated with Words: Implications for Early Vocabulary Acquisition
Andrew Biemiller

Are there different kinds of meanings in terms of internal representations acquired at different ages, and are some of these meanings more important than others for the later development of vocabulary?

Concepts about different kinds of meanings are taken from existing research literature, especially the work of James Gibson (1965) Eleanor Gibson (1969), Terrence Deacon (1997), and Robbie Case (1985). Using these, I distinguish between:

- concrete meanings (objects, settings, and actions);
- relational meanings (function words—prepositions, conjunctions, and articles, modifiers, related objects including terms like aunt/niece, doctor/patient), and probably other relational meanings);
- symbolic meanings (dimensions—size, color, shape, quantities and operations—number, 17, add, sequence, meta-cognitive terms—remember, imagine, plan, and doubtless many other symbolic topics).

As Deacon (1997) suggests, concrete and relational word meanings are probably meanings that also exist for many animals, although obviously not accessed by oral words. Symbolic word meanings probably have no direct analogous meaning for animals.

Empirical data on when words are acquired are drawn from Dale and O'Rourke's Living Word Vocabulary, Hart and Risley's The Social World of Children Learning to Talk, Biemiller's Words Worth Teaching, and research by Scarborough (2004).

These sources show some concrete and relational meanings by age 3, and others that are established by age 5 or later. All or most "symbolic" meanings are not acquired until after age 5.

Function words are necessary to construct many meaningful sentences. Children who acquire more function words before kindergarten (age 5), may be better able to assemble other new meanings—including symbolic meanings starting around age 5—than children with fewer function words. I have constructed a fairly complete list of function words and when they are acquired. Examples are: known by age 3 (and, on); known by most by grade 2 but not by most by age 3 (as, before), known by some by grade 2 (if, opposite), not learned until later than grade 2 (however, while). I will make the complete list available at the conference.

At this point, it is possible to identify many relational word meanings that are learned in early years by some but not all children. Word meanings learned by some but not all are words that other children will learn later but build vocabulary more slowly (Biemiller & Slonim, 2001). To prove that these are important prerequisites to building later vocabularies will involve (a) longitudinal data showing that acquiring more function words early is associated with acquiring more vocabulary (especially symbolic vocabulary) later, and (b) instructional data showing that teaching or otherwise fostering acquisition of more function words before age 5 significantly increases acquisition of vocabulary (especially symbolic vocabulary) after age 5.

Platform Session 1.2

11.00—11.20

Repetition Disfluencies as a Window on Lexical Competition

Zara Harmon, Vsevolod Kapatsinski

11.20—11.40

A probability-based account of tonal representations in the Mandarin mental lexicon

Seth Wiener, Kiwako Ito

11.40—12:00

Phonological and semantic activation of homophones within the recognition of Japanese kanji compound words

Chikako Fujita, Taeko Ogawa, Hisashi Masuda

Repetition Disfluencies as a Window on Lexical Competition

Zara Harmon, Vsevolod Kapatsinski

Several studies have suggested that semantically related words compete for selection in production. For example, picture naming is slower in the presence of an auditory distractor word semantically related to the target (Schriefers, 1992, 1993; Meyer, 1996). In the domain of disfluencies, Beattie & Butterworth (1979) observed that low-predictability lexical items were more likely to be preceded by pauses. Hartsuiker & Notebaert (2010) found that picture naming was more disfluent when the participants could not agree on the name of the picture. These results suggest that disfluencies may arise in part when the speaker needs time for lexical access.

The present study is an effort to study semantic competition during lexical access by examining its effects on disfluency; particularly, repetition repair. Repetition repair involves interruption in the flow of speech when the speaker repeats something s/he just said, e.g. "So, we need [to + to] build on something more positive". One function of repetition is hypothesized to be buying time to plan upcoming speech, including lexical access (Schegloff et al. 1977). If this is correct, and semantically related words compete for selection, then we expect to see longer repetition repairs before words that have many semantic competitors and are less frequent than their competitors.

We examined all instances of one-word and two-word repetitions preceding main verbs in the Switchboard Corpus. We focused on verbs to be able to keep the syntactic structure of the potentially repeated string relatively invariant. Results on nouns are expected by the time of the conference. This included 2858 instances of one-word repetitions and 776 instances of two-word ones. A machine-readable version of Roget's Thesaurus (Roget 1911) was used to retrieve the number of synonyms for each verb. Frequencies for the verbs and their synonyms were retrieved from Switchboard. We tested 5 predictors: number of semantic competitors of the verb, frequency of the base form of the verb, frequency of the conjugated form of the verb, mean base form frequency of the competitors, and the maximum frequency in the competitor set. Models of lexical competition differ in whether mean frequency of the competitors or the frequency of the strongest competitor should matter (e.g. Bard & Shillcock 1993) and in whether competition involves base and/or conjugated forms (e.g. Roelofs 1997, Stemberger & MacWhinney 1986).

All predictors were transformed using log or square root transforms to reduce skew. Multi-model inference with logistic regression (Burnham & Anderson 2002, Kuperman & Bresnan 2012) by means of the MuMIn package (Barton 2013) in R was used to identify the important predictors. Frequency of the base form of the target ($z = 2.591$, $p = .009$) and the maximum frequency of the competitors ($z = 4.403$, $p < .001$) were found to be significant predictors of the length of the recycle: Two-word repetitions appear in the context of a following verb with a low base frequency which has a competitor with a high frequency. One-word repetitions, however, appear in the context of higher frequency main verbs with competitors of low frequency.

These results provide evidence for the hypothesis that speed of lexical access negatively correlates with the length of recycle so that the more effortless the access process, the shorter the length of the recycle. This finding supports the function attributed to repetition repairs, i.e. buying time for planning, including lexical access. It also provides further confirmation of the existence of competition among semantically related words during the lexical access process and suggests that lexical competition is better modeled using relative frequencies of base forms of a select set of strong competitors.

A probability-based account of tonal representations in the Mandarin mental lexicon

Seth Wiener, Kiwako Ito

Word recognition in tonal languages involves processing both segmental and suprasegmental information. Recent findings from eye tracking and ERP studies suggest that tonal and segmental information are accessed concurrently and play comparable roles in Mandarin and Cantonese lexical activation. These studies implicitly assume equally detailed static representations of tone across all syllable types in the lexicon. Prevailing models of the Mandarin lexicon similarly assume well-defined representations at the syllable, morpheme and word levels. This is problematic for two reasons: first, while some Mandarin syllables combine with multiple tones to form words, others combine with only one tone, making tone specification redundant for lexical access. Second, the majority of syllable-tone combinations correspond to multiple homophones - as many as ninety in some cases (e.g., *yi4*). Thus, the validity of tonal information may depend on the degree of uniqueness of the given syllable-tone combination in the lexicon. Highly probable tones may facilitate, whereas improbable and less predictable tones may slow down word recognition.

This hypothesis was tested using two experimental paradigms – eye tracking and gating. The experiments manipulated syllable frequency (high/low) and tonal probability (most probable/least probable) based on. In an eye tracking study, 20 native mono-dialectal Mandarin speakers' eye-movements were monitored while they searched for Chinese characters that matched spoken words. Of particular interest was the competition between the target (e.g., *zhou1* – an infrequent syllable carrying a most probable tone) and the segmental-competitor (e.g., *zhou2* – the identical syllable carrying a least probable tone). Results revealed that participants fixated earlier and clicked faster on syllables with highly probable tones, but only when hearing infrequent syllables. Crucially, fixations were drawn to characters with probable tones when listening to target words with improbable tones. This finding suggests that listeners track, store and make use of tonal likelihoods in a top-down manner during lexical access, especially when tonal information can facilitate

identification of words in relatively less dense neighborhoods.

A follow-up gating study aimed to further clarify (1) how much of the acoustic signal listeners need to hear to start anticipating a particular tone for the incoming word and, (2) whether the timing of tone anticipation depends on the validity of tone for the given word. Participants heard 40 ms increments of target syllables with either a probable or improbable tone and typed the word that they thought they heard in pinyin (i.e., syllable and tone). Responses from 24 mono-dialectal Mandarin listeners revealed an interaction between syllable frequency and tonal probability at the 2nd gate (onset plus 40 ms); exposed to less than 30% of the word, participants were most accurate in identifying infrequent syllables with most probable tones, and least accurate in identifying infrequent syllables with least probable

tones. This trend continued until the 4th gate (onset plus 120 ms), hinting that the fixations to incorrect characters in the eye-tracking experiment may have been triggered by early acoustic cues that were sufficient for segmental identification.

In sum, these studies demonstrate that tonal information is selectively exerted according to the cue validity during spoken Mandarin word recognition. Our findings show that the role of tone in the lexicon is higher for infrequent words/syllables, which are generally considered to have higher activation thresholds and thus may require more detailed phonological representations. Given the idiosyncratic nature of the Mandarin lexicon, we argue that speakers construct dynamic representations of tone as a potential means to overcome the reduced syllabary and high degree of homophony.

Phonological and semantic activation of homophones within the recognition of Japanese kanji compound words

Chikako Fujita, Taeko Ogawa, Hisashi Masuda

Many studies of visual word recognition have provided evidence that automatic phonological activation is a prerequisite to accessing the meanings of words (e.g., Van Orden, 1987). For example, Lesch and Pollatsek (1993) demonstrated with priming experiments that, in addition homophones of the targets, primes that are homophonous with words semantically related to the targets also facilitated target naming. Their finding suggests, for example, that beach presented as a prime would activate the homophone of beech, which, in turn, would activate the semantically-related word nut before its presentation as a target.

The present study investigates whether similar patterns of priming might be observed in the recognition of Japanese words. Because Japanese has many homophones, in contrast to English, we hypothesize that the semantic activation of homophones is inhibited in order to access the meanings of presented target words.

Adopting the masked form-priming paradigm, we prepared four types of targets based on the relation to their primes using two-kanji compound words: (1) repetition (e.g., 電線-電線 /

den-sen/, *electric cable*), (2) homophone (e.g., 電線- 伝染 /den-sen/, *contagion*), (3) semantic associate of a homophone (e.g., 電線-病気 /byōki/, *illness*), and (4) unrelated (e.g., 電線-政界 / seikai/, *political world*). Forty native Japanese undergraduates participated in a lexical decision task experiment.

Consistent with prior studies with English words (Lesch & Pollatsek, 1993), analysis of results reveal that responses to semantic associates of a homophone were significantly facilitated compared to the unrelated condition. This finding suggests that the meanings of homophones to the prime are activated by a phonologically-mediated route and that activation spreads to semantically-related words during an early stage of processing. However, the present study failed to observe priming effects in the homophone condition, despite the strong facilitation observed in the repetition condition. These findings indicate that the meanings of homophones are inhibited by strong activation of the prime's meaning that may be occurred by directly but slowly spreading activation from orthographic and/or morphological information rather than the phonologically mediated activation.

Poster Session 1.2

14.00—15.00

1. Learning to read in Spanish: when does morphological complexity have a role?

María Josefina D'Alessio, Virginia Jaichenco, Maximiliano Agustín Wilson

2. A set of 400 pictures standardized for Tunisian Arabic: Norms for imageability, subjective frequency, name agreement, and familiarity

Mariem Boukadi, Cirine Zouaidi, Maximiliano A. Wilson

3. Morphological Transcendence: Morphemic Boundary Ambiguity Produces Conflict at the N4

Charles P. Davis, Gary Libben, Sidney J. Segalowitz

4. Directionality and underspecification: the processing of zero-derivation

Jeannique Darby

5. Frequency effects in bilingual (L1 and L2) and monolingual natural reading

Uschi Cop, Denis Drieghe, Wouter Duyck

6. The Influence of Gradient Foreign Accentedness on Lexical Activation and Retrieval

Vincent Porretta, Benjamin V. Tucker, Juhani Järvikivi

7. The role of exemplars in word recognition

Annika Nijveld, Martijn Bentum, Mirjam Ernestus

Learning to read in Spanish: when does morphological complexity have a role?

María Josefina D'Alessio, Virginia Jaichenco, Maximiliano Agustín Wilson

The role that morphology plays in literacy acquisition has been shown in different languages (i.e. French, English, Italian). Morpheme-based reading is used to process less familiar or new words (Burani et al, 2008; Jaichenco & Wilson, 2013). According to studies performed in other languages, this morpheme-based reading is gradually replaced by a whole-word reading procedure during normal development (Marcolini et al., 2011).

This study aimed at examining the role of morphology in literacy acquisition in Spanish. Two word naming experiments were carried out.

In Experiment 1, participants were asked to name a list of words where morphology (simple and suffixed derived words) and frequency (high and low) were factorially manipulated to create four experimental groups of 20 words each. All stimuli groups were matched by word, suffix and root length, bigram frequency, N-size, imageability and initial phoneme. Twenty 2nd grade (mean age=7.11 y.o.) and 17 4th grade (mean age=9.4 y.o.) Spanish-speaking children participated in the study. Stimuli were presented using DMDX software (Forster & Forster, 2003). Reading latencies and error rates were registered and cor-

rected with Check Vocal (Protopapas, 2007) and were analyzed using a mixed effects model. Grade, morphology and frequency affected RTs and errors. The interaction of grade x morphology was also significant. Morphology and frequency were found to be significant in 4th grade. However, only frequency was significant for the 2nd grade.

These results were surprising, since they contradicted the prediction that the effect of morphology in reading would be reduced with reading experience. For this reason, we decided to carry out a second experiment with 6th graders.

In Experiment 2 the task and stimuli were the same as those used in experiment 1. Twenty-three advanced 6th grade chil-dren (mean age=12.4 y.o.) participated in the study. Stimuli pre-sentation and data analyses were the same as in Experiment 1. The results showed an effect of frequency but neither mor-phology nor the interaction of morphology x frequency affected performance.

As reported in other languages (Marcolini et al., 2011), our re-sults show that morphology plays a role in complex words read-ing in Spanish and that this effect appears as soon as the child starts moving away from a fundamentally sublexical reading to a primarily lexical reading, but disappears both for high fre-quency and low frequency words when children become more proficient readers.

A set of 400 pictures standardized for Tunisian Arabic:
Norms for imageability, subjective frequency, name agreement, and familiarity
Mariem Boukadi, Cirine Zouaidi, Maximiliano A. Wilson

The use of standardized pictorial stimuli in research on lan-guage processing, memory, and perception allows for a more reliable comparison between different studies and better con-trol of psycholinguistic variables. Over the years, Snodgrass and Vanderwart's (1980) pioneering set of standardized pictures has been extended and norms have been collected for different languages (e.g., French, Spanish, and Greek). However, no such normative database exists for Arabic. The purpose of the pres-ent study was to provide Tunisian Arabic (TA) norms for 400 line-drawings taken from Cycowicz, Friedman, Rothstein and Snodgrass (1997) that include Snodgrass and Vanderwart's 260 pictures.

Method

Participants. One hundred TA native speakers (mean age = 24 years old; mean education = 16 years) took part in this study. The sample was subdivided into four different groups (n = 25 for each task).

Tasks. Three rating tasks (imageability, subjective frequency, and familiarity) and one picture- naming task (name agreement) were run on the DMDX software (Forster & Forster, 2003).

Data analysis. Two correlational analyses were conducted: 1) among the four variables measured in this study, and 2) be-tween the present TA norms and the French ones for the same picture set (Alario & Ferrand, 1999; Desrochers & Bergeron, 2000; Desrochers & Thompson, 2009; Bonin, Méot, Ferrand, & Roux, 2011).

Results

Positive and significant correlations were found among the four TA variables (all ps < .01). The strongest correlations were between familiarity and subjective frequency (r = .73), the weak-est between imageability and name agreement (r = .25). Signifi-cant correlations (all ps < .01) were also found between the TA and French norms. The strongest correlations were between TA and French norms of familiarity and subjective frequency (rs = .70 and .62, respectively).

Conclusion

The strong relationship found between familiarity of the pic-tures and their names in TA seems to indicate that the names of the most familiar concepts are also the most frequent. The association between familiarity and imageability indicates that the most familiar concepts are also the easiest to image. The as-sociation between French and TA for familiarity and subjective frequency seem to indicate that pictures and their names are equally familiar for Tunisian and French speakers. However, it was more difficult for Tunisian subjects to generate a single most common name for the pictures in the name agreement task (M = 59% Vs. M = 84% in French). In sum, this study is the first to offer such a sizeable normative database for Arabic. It will serve to improve the quality of experiments involving Arabic-speaking subjects and will allow their comparability with other intra- and cross-linguistic studies.

Morphological Transcendence:
Morphemic Boundary Ambiguity Produces Conflict at the N4
Charles P. Davis, Gary Libben, Sidney J. Segalowitz

At the core of Libben's (2010) morphological transcendence is maximization of opportunity. When we process compound words – for instance, boardroom – possible activations for 'board' would include 'board', '-board', and 'board'. This creates lexical conflict, where the processing of compound words in-volves automatic, obligatory decomposition. Though this is an inefficient system, it ensures that all possible representations that can be activated from left-to-right parsing are available at the lexical level. We conducted an event-related potential (ERP) study to investigate whether processing of ambiguous morphe-mic boundary novel compounds differs from that of unambigu-ous novel compounds as a function of constituent frequencies.

Participants were 22 undergraduate students who performed a lexical decision task on 80 real compound words and 80 nov-el English compound words presented six times each (once in each of six blocks of trials). Sixty of the novel compounds were the focus of the present analyses. These words varied in the ambiguity of the morphemic boundary, that is, the boundary between the first and second morpheme was either ambiguous (e.g. sodacorn) or unambiguous (e.g. watchpanic). We conducted regression analyses predicting ERP components (P1, N170, P2, P3, and N4) from the four word frequency values: the frequency

28   *The 9th International Conference on the Mental Lexicon*

of the first-boundary first constituent (e.g sod; watch), the second-boundary first constituent (e.g. soda), the first-boundary second constituent (e.g. acorn; panic), and the second-boundary second constituent (e.g. corn).

The N4 showed significant differences facilitated by the frequency of the second-boundary first constituent (R2 = .176). As the N4 indexes differences in processing difficulty for retrieval from semantic memory (Kutas & Delong, 2008), it appears that the activation of the second-boundary first constituent competes with that of the first-boundary first constituent. This would support morphological transcendence (Libben, 2010). We would not expect differences as a function of the first-possible constituent, as this initial morpheme activation is available for both ambiguous and unambiguous compounds. Further, if only the last-possible parse were activated, we would anticipate an effect of word frequency earlier than the N4, as word frequency might modulate ERPs as early as the P1 (approximately 100 ms; Penolazzi, Hauk, & Pulvermuller, 2007). This seems to indicate a left-to-right parsing procedure which maximizes opportunity for lexical access in support of Libben, Derwing, and de Almeida (1999), who demonstrated that prelexical parsing aims to supply all possible parses of a written string.

Directionality and underspecification: the processing of zero-derivation
Jeannique Darby

Forms in English which are used as both nouns and verbs (e.g., CLOAK, BITE) have often been classified according to which form is derived from the other, in a process frequently called 'zero- derivation' or 'conversion' (cf. Marchand, 1963; Kiparsky, 1982; Beard, 1995). It has further been claimed that, as in derivation via affixation, an item derived through conversion is more 'morphologically complex' than its base. For example,

a) Verb Base (V_B): (to) [BITE$_V$] *less complex than* (a) [[BITE$_V$]$_N$]
b) Noun Base (N_B): (a) [CLOAK$_N$] *less complex than* (to) [[CLOAK$_N$]$_V$]

An alternative view argues that there is no difference in complexity, and that directionality is not synchronically represented in the morphology (e.g., Lieber, 1981; Farrell, 2001). Thus, for some cases, directionality is not always clear: e.g., is the verb GUARD derived from the noun ([[GUARD$_N$]$_V$]: 'to act as a *guard$_N$*'), or is the noun derived from the verb ([[GUARD $_V$]$_N$]: 'one who *guards$_V$*')? Farrell (2001) suggests that neither is derived, and that such 'pairs' may actually be a single entry in the lexicon, underspecified for word class.

We investigated these opposing views using two lexical decision tasks in the delayed priming paradigm, which previous research (Henderson et al., 1984; Drews and Zwitserlood, 1995) suggests may show morphological processing effects which are distinguishable from effects of purely semantic or phonological relatedness. Experiment 1 tested the relative impact of prior presentation of a related -ing form on four different types of target words: basic nouns (N_B Nouns); verbs derived from these nouns (N_B Verbs); basic verbs (V_B Verbs); and their converted nominal counterparts (V_B Nouns). Experiment 2 then tested the priming of nouns which were members of directional pairs (N_B Nouns and V_B Nouns) as compared to frequency- matched non-directional items (uN_B Nouns and uV_B Nouns). Directional items were grouped based on surveys of speaker intuition; the underspecified items (judged by speakers as 'non- directional') were further categorised based on CELEX tags, which were also matched to speaker ratings for directional items. Each of the target groups in the two experiments appeared 6-8 items after either the -ing form of the verb (e.g., *cloaking*), or an unrelated -ing form.

Experiment 1 showed an asymmetry in the facilitatory effect of related -ing forms on V_B vs. N_B items. Since the primes are verbal forms, both types of -ing primed their respective verbs. Morphologically-related V_B Nouns were also facilitated. However, the additional effort required to further decompose an N_B prime like [[[cloak$_N$]$_V$]ing] into its base noun mitigated the facilitation of the N_B Noun, leading to a small effect which was not statistically significant. Experiment 2 then revealed a greater priming effect for non-directional nouns than for directional ones. This suggests that, despite the difference in the underlying structure of N_B and V_B -ing primes, they are both less closely related to their respective nouns than the non-directional primes. Together, the results support the view that directionality in some conversion pairs is represented on a morphological level in the grammar, but that some pairs may not only be non-directional, but may even be a single lexical entry without a fixed word class specification.

Frequency effects in bilingual (L1 and L2) and monolingual natural reading
Uschi Cop, Denis Drieghe, Wouter Duyck

Monolingual and bilingual eye movements in first (L1) and second (L2) language natural reading of a book were used to investigate whether bilingualism and L2 proficiency modulate the frequency effect (FE). The weaker links account (Gollan & Acenas, 2004) predicts a larger FE for bilinguals in L2 compared to L1 and a larger FE for bilinguals than for monolinguals, because of a lower exposure to the lexical items in the bilingual lexicon. It has indeed been shown in word isolated comprehension tasks, like the lexical decision task (e.g. Duyck et al., 2008), that bilinguals show a larger FE in L2 than in L1. Whitford and Titone (2011) find the same for sentence embedded target words in a paragraph reading task. Also they find that L2 proficiency modulates the FE's.

Our study is the first that compares not only the L1 and L2 FE's of bilinguals, but also the L1 bilingual FE and the monolingual FE in language comprehension. Also, L1 proficiency was included in our analyses and we analyzed all content words in the text, not only target words.

We find a larger L2 FE than L1 FE for bilinguals for single fixation durations and skipping rates. A modulation of the FE by L2

proficiency and L1 proficiency is also found. Both when reading in L1 and L2 the FE is larger when L2 proficiency is higher and L1 proficiency is lower. The fact that a higher exposure to L2 and a lower proficiency in L1 causes the L1 FE to enlarge provides partial evidence for the weaker links account. The monolingual FE was comparable in size to the bilingual L1 FE.

The Influence of Gradient Foreign Accentedness on Lexical Activation and Retrieval
Vincent Porretta, Benjamin V. Tucker, Juhani Järvikivi

Native listeners are sensitive to deviations from typical native productions and the degree of deviation affects the perception of foreign accentedness. However, the gradient nature of foreign accentedness has not yet been thoroughly examined in lexical processing. Here we present two studies, one a cross-modal identity priming experiment, and the other a visual word eye-tracking experiment, which aim to investigate the roles of gradient foreign accentedness and listener experience in the activation of lexical representations and lexical retrieval. Assuming that representations contain detailed information (cf. Pierrehumbert, 2001), we expect activation and retrieval to vary along the continuum of foreign accentedness and by level of listener experience with foreign-accented speech. Forty monosyllabic English words were extracted from the Wildcat corpus (Van Engen, et al.,

2010), each recorded by four talkers (one native English, three native Chinese), representing the full scale of accentedness ratings (Porretta & Tucker, 2012). For the priming experiment, each token was matched with a written target (identity of the prime, an unrelated word, or a pseudo- word). Responses and reaction times of 48 participants were r ecorded during lexical decision. For the eye-tracking experiment, each was paired with four written words (identity, onset competitor, rhyme competitor, and unrelated word, cf. Allopenna, et al., 1998). A different group of 48 participants had their eye movements recorded while locating the written form of the spoken word. All participants responded to a questionnaire assessing their experience interacting with Chinese-accented speakers. Cross-modal Priming: Generalized additive mixed modeling (Wood, 2006) of the reaction times reveals that reaction times were significantly faster when the target word matched the auditory prime. Interestingly, however, when examining only these Prime-Identity trials, differential non- linear effects of accentedness rating emerge between listeners in high and low experience groups. Namely, high experience listeners have lower reaction times overall which then spike for very highly accented primes. Low experience listeners on the other hand have higher reaction times overall and display a more gradient increase across the accentedness continuum.

Visual Word Eye-tracking: Logit-transformed fixation proportions to target were modeled over the period of 200–700 ms post stimulus onset using generalized add itive mixed modeling. Increased accentedness results in decreased fixations to the target word, with a non-linear cline across the continuum. High experience listeners show increased fixations across the continuum particularly for mid-range accentedness values while the low experience group shows reduced fixations and a more precipitous decrease across the continuum later in the interest period.

The results of both studies indicate that native-like productions facilitate lexical access more than productions that deviate from native norms. The priming study suggests that native and weak accent produce stronger lexical activation, while the eye-tracking study suggests that these same tokens result in more rapid and successful access. In both, this facilitation is affected by experience interacting with Chinese-accented speakers. Thus, high experience listeners may have more detailed representations on which to map the production. This may indicate that, even in adulthood, lexical representations are shaped through experience with variation.

The role of exemplars in word recognition
Annika Nijveld, Martijn Bentum, Mirjam Ernestus

Various studies reported evidence that listeners store word tokens with their acoustic details. In these experiments, words were repeated and the recognition of the second occurrence of a word (target) was faster and/or more accurate when surface details (e.g., speaker voice) of the first occurrence (prime) and the target matched compared to when they did not (e.g., Craik and Kirsner, 1974; Bradlow, Nygaard and Pisoni, 1999). Apparently, the exact pronunciation of the prime was retained in memory, in the form of an exemplar. It is still unclear under which circumstances these exemplar effects occur (an issue discussed in more detail in Hanique, Aalders and Ernestus (2013)). It is necessary to establish the role that exemplars play in word recognition, as it has important implications for our understanding of the speech comprehension process. We therefore further investigated this issue.

We conducted four priming experiments (24 participants in each), consisting of a prime block and a target block. In the target block, the words of the prime block reoccurred in addition to new words. In the prime block, participants either classified the speaker as male or female (Experiments 1 - 2) or performed a semantic categorization task (Experiments 3 - 4). In the target block, participants either identified words as old or new (old/new word judgment), which requires the use of episodic memory (Experiments 1 and 4), or performed semantic categorization (Experiments 2 - 3), which does not. A prime and target could be spoken by the same or by a different speaker.

We observed exemplar effects (an advantage for the repeated words that were pronounced by the same compared to a different speaker) only in Experiment 1, in which participants performed male/female voice judgment and old/new word judg-

ment. Our results therefore suggest that exemplar effects arise when the task in the prime block elicits shallow processing and/or focuses participants' attention to the variation in speaker voice in the experiment (such as in the voice judgment task) and when the task in the target block stimulates participants to think back to the previous occurrence of the word.

The circumstances under which exemplars occur thus appear to be rather restrictive, and, we argue, not representative for natural listening situations. In everyday word recognition, shal-low processing rarely happens as the goal of the listener is to process meaning. Furthermore, the fact that we found exemplar effects only when participants were encouraged to think back to the previous occurrence of the word, suggests that the effects rely on episodic memory. This would imply that exemplars are part of episodic memory and not of the mental lexicon. If so, this has important implications for theories of speech comprehension.

Grammatical affordances, or what we learned from faking a case system for English
Nicholas Lester, Fermin Moscoso del Prado Martín

Previous research suggests that the probability distribution of a word's inflected variants influences the recognition of that word. Recently, Baayen et al. (2011) reported similar effects for English trigrams beginning with a preposition (e.g., *in the bucket*). These findings suggest that grammatical relations, whether morphological or syntactic, shape the mental representation of words. The nature of the stimuli used in the Baayen et al. (2011) study raises several questions about the precise source of the observed effect. For instance, while the patterns of usage of the prepositional trigrams do indeed capture *some* of the structural mechanisms by which English encodes grammatical information, sheer co-occurrence at short distances is not the sole way in which such information is encoded. More sophisticated structural factors also encode these relations: syntactic position distinguishes subject (nominative case) and object (accusative case); prepositions may be separated from the heads of the NPs they govern by potentially long strings of words (certainly more than by a single determiner); and so on. Furthermore, it is not clear whether, by examining only the short-distance relations between nouns and prepositions, one is not just tapping into purely semantic factors, which are known to be strongly reflected at such short distances (cf., Bullinaria & Levy, 2007). In fact, Moscoso del Prado (2007) showed that short-distance semantic effects can even account for the facilitatory effect of inflectional entropy on visual lexical decision RTs without reference to the inflected form itself. It might be the case, then, that larger distances between preposition and head noun diminish or utterly remove the effect.

In this study, we investigate whether plain lexical co-occurrence can account for such effects, and whether such effects are semantically motivated. We 'fake' a case system for English using the distribution of syntactically specified grammatical functions served by nouns (as extracted from a treebank). Each case was defined relative to a particular node in the syntactic tree or to its being dominated by one of a set of prepositions whose relational meaning is encoded by inflectional case marking in other languages. Based on these syntactic factors, we defined a fake inflectional entropy parallel to that computed for inflectionally richer languages in prior studies. As expected, we found that this new measure correlates negatively with visual lexical decision RTs. Surprisingly, however, in a virtual lexical priming experiment, we found no correlation between our measure and the effects of semantic priming or similarity. Taken together, these results suggest that grammatical relations so defined play a different role in structuring lexical representations than do actual morphological relations, and that this role is apparently independent of the kind of tight semantic similarity necessary to produce semantic priming effects.

Transposed-Letter Effects on Processing Chinese Compound Words
Yun Yao, Peiyun Zhou, Kiel Christianson

Unlike most Indo-European languages, Chinese is "the poster child of compounding" and has a morphology with very little affixation (Myers, 2006). While the morphemes of some Chinese compounds still remain semantically transparent (e.g., 晚饭 *evening-meal* "dinner"), others are no longer semantically related to the meaning of word (e.g., 东西 *east-west* "thing") (Packard, 2000). Furthermore, Chinese compounds have several different sub-structures, such as subordinate and coordinative (Kuo & Anderson, 2006). For example, while the morpheme 黑 "black" modifies 板 "board" in the subordinate compound 黑板 *black-board* "blackboard," both morphemes 饮 "drink" and 食 "eat" contribute equally to the meaning of the coordinative compound 饮食 *eat-drink* "diet."

To understand how words are represented in the mental lexicon of Chinese speakers, we need to know how morphological processing is involved in visual word recognition. Transposed-letter (TL) effects have been used to explore the processes of morphological decomposition in a variety of alphabetic languages (e.g., Christianson et al., 2005). However, the morphological processing of Chinese words has not been as well documented. Additionally, despite a handful of studies that have investigated TL effects in sentence contexts, the majority of the previous studies used priming paradigms. Although such paradigms are effective in capturing the processing of words in isolation, they do not allow reading in natural linguistic contexts and may not reflect naturalistic language processing.

This eye-tracking study addressed these issues by examining the TL effects on the processing of Chinese compounds in sentence contexts. Specifically, we investigated: (1) Does transposing the morphemes of Chinese compounds produce TL effects? (2) How do semantic transparency and compound sub-structure modulate the effects? In the experiment, 30 Chinese native

speakers were presented with 112 sentences that contained four types of compounds and their transposed forms: transparent, subordinate; transparent, coordinative; opaque, subordinate; and opaque, coordinative.

Early measurements showed that transposed opaque compounds were read more slowly than controls, while no reading time difference was observed for transparent compounds. Late measurements, however, showed that both transparent and opaque compounds were read more slowly when transposed. No effect of compound structure was found. These findings suggest that the time course of morphological decomposition is modulated by semantic transparency in Chinese.

Does similarity count? Factors in bilingual learning of cognates
Agnieszka Otwinowska-Kasztelanic, Jakub Szewczyk

Bilinguals process cognate words faster than non-cognates (Djikstra et al. 2010) and in experimental settings they also learn cognates faster (de Groot and Van Hell 2005). However, contrary to experimental studies, learners in the classroom vary in the extent they take advantage of cognates because they do not perceive them as equivalent in languages distant typologically (Schmitt 1997, Singleton 2006).

In this study we determine which factors have an impact on learning cognates across two typologically distant languages. We focus primarily on the extent to which orthographic similarity between words in L1 Polish and L2 English facilitates learning, and when it leads learners into wrong assumptions concerning semantic similarity. For this purpose, participants (N=150) were presented with randomized lists of 120 English adjectives and abstract nouns (40 cognates, 40 false friends and 40 non-cognate controls) and asked to translate them into Polish stating their confidence level. By measuring participants' confidence level and performance in translations of false friends we corrected for guessing strategies in translating words that had orthographic neighbours in Polish. We also controlled participants' level of L2 English (by measuring their translation of control words) and their best L3 (Multilinguals-Low vs. Multilinguals-High). All stimuli were controlled for frequency; cognates and false friends were controlled for the degree of similarity (Levenshtein distance) between their orthographic L1 and L2 forms.

The study reveals that the more similar the L1 and L2 forms of cognates, the easier they were to learn. High frequency words were better known that low-frequency words, but cognates and false friends benefited from frequency more than other words. Multilinguals-High benefited more from cognateness than Multilinguals-Low, particularly those with low proficiency in L2. These results suggest that familiarity of word form amplifies vocabulary acquisition. It also hints that proficiency in any L3 might help develop better strategies to take advantage of cognates.

The Representation of Noun-Noun Compounds: A Single Mechanism View
Pyeong Whan Cho, Whitney Tabor

By noun-noun compounds, we mean any combinations of nouns that native speakers can understand. Noun-noun compounding seems to be productive such that native speakers can easily understand novel compounds (e.g., *mountain magazine*). On the other hand, there are many compounds (e.g., *snowman*) that have idiosyncratic meanings. We will call the two types as novel and lexicalized compounds. According to the words-and-rules theory (Pinker, 1999), idiosyncratic meanings are retrieved from a mental lexicon while compositional meanings are computed on the fly by a rule system. It naturally follows that lexicalized compounds are treated by a lexical route but novel compounds are treated by a rule system. We propose an alternative view: all compounds are processed by a single mechanism and represented in the same space. The comprehension of both types requires building a constituent structure [NN/R N1, N2] that is shaded by a relation (cf., Levi, 1978) and propose a continents-and-islands model according to which idiosyncratic relations (used in lexicalized compounds) are like islands close to but separated from other continents in which common relations (used in novel compounds) are represented, emphasizing the competition between idiosyncratic and common relations. Note that a language processing system to activate the target idiosyncratic relation given a lexicalized compound under the pulling force from other common relations available for each component noun. To avoid misinterpretation, the system will develop inhibitory connections between idiosyncratic and other common relations, predicting negative priming between two types. In an experiment, we investigated if negative priming between lexicalized and novel compounds is observed in both directions in sentence reading. We introduced structural parallelism by using a coordinate structure. An example sentence is as follows: "Sophia / thought about / glass doors, / leather pants, / and / sandcastles / in the / morning." We used two primes (*glass doors* and *leather pants*) to introduce a stronger priming effect on a target (*sandcastles*). We used a 2x3 mixed factorial design in which target compound type (T: LEX [lexicalized] vs. NOV [novel]) was a between-subject factor and prime type (P: BL [baseline], DR [different relation], and SR [same relation]) was a within-subject factor. Primes in the BL condition were A+N (T=LEX) or monomorphemic nouns (T=NOV). Primes in DR and SR conditions were novel (T=LEX) or lexicalized compounds (T=NOV). Primes and targets instantiated different relations in DR but similar relations in SR. Sixty undergrads participated for course credit. They read the sentences like the example in a self-paced reading task. The residual log reading times at the target and its following frame ("in the") were analyzed. The main effects of target type ($p < .0001$) and prime type ($p < .012$) were significant but the interaction effect was not ($p > .9$). More importantly, reading time was slower in DR ($p < .018$) and SR ($p < .004$) than in BL, supporting our single mechanism view. Although

the words-and-rules theory also predicts competition between lexicalized and novel compounds, it cannot explain slower reading in DR and SR conditions than in BL conditions because in all three conditions, the lexical route would be primed when T=LEX and the rule route would be primed when T=NOV. Thus, competition between two routes would be comparable in three conditions. We conclude that a single mechanism view provides a better understanding of compound processing.

Inter-letter typing speed as an index of morphological processing
Thomas Spalding, Christina Gagné, Kelly Nisbet, Juana Park

The role and extent of morphological processing of words is contentious, to say the least. There have been a range of proposals with respect to the degree to which morphological processing is necessary (see, e.g., Bybee 1995; Giraudo & Grainger 2000; Roelofs & Baayen 2002; Sandra 1994; Taft & Kougious 2004). There have recently been proposals that the language system attempts to construct a literal, transparent meaning for any word that is a possible compound, even when such processing would seem to be detrimental (Gagné & Spalding 2009, 2010; Ji et al. 2011; Spalding & Gagné 2014). Spalding and Gagné, for example, found that the availability of a good, literal meaning for an opaque compound was associated with slower correct lexical decisions to that compound. Demonstrating (pseudo)morphological effects in pseudo-compounds would be a strong test of the idea that meaning construction is attempted whenever a potential compound is encountered.

Libben & Weber (2014) showed that inter-letter typing speed was very sensitive to morphological structure, in that compounds showed highly elevated typing times for the first letter of the second constituent of a compound word regardless of the semantic transparency of the constituents, suggesting a morphological rather than a semantic effect. Thus, inter-letter typing time should be a good index of the extent to which pseudo-compounds engage morphological processing. The current project uses inter-letter typing speed to investigate the extent to which morphological structure contributes to the processing of compound and pseudo- compound words. Of particular interest is the comparison of fully opaque compound words such as *hogwash* and pseudo-compound words such as *carpet*, as these words differ primarily with respect to morphological structure, but are similar with respect to the degree to which the (pseudo) constituents contribute to the meaning of the word.

In two experiments, we found indications of morphological processing for pseudo-compounds: There were significantly elevated inter-letter typing times around the (pseudo)constituent boundary. However, there were also differences between pseudo-compounds and fully opaque compounds. First, the inter-letter typing time elevation was much smaller for pseudo-compounds than for fully opaque compounds. In addition, the typing time elevation was spread across the letters before and after the (pseudo)constituent boundary for pseudo-compounds, but concentrated only on the letter after the constituent boundary for the fully opaque compounds. Third, we presented compound and pseudo-compound words with the order of their constituents reversed, and found that reversal had little effect on the typing time elevation for the compounds, but a large effect on the typing time elevation for the pseudo-compounds.

Taken together, the results suggest that a) pseudo-compounds result in morphological processing, b) the language system differentiates between pseudo-compounds and opaque compounds, and c) opaque compounds, in terms of typing, benefit little from their status as known words.

The Grammatical Gender System in the Mental Lexicon of Romanian-French Bilinguals
Amelia Manolescu, Gonia Jarema

Studies on the organisation of the grammatical gender system in the bilingual mental lexicon have not yet reached a consensus. Some support the view that the systems of the two languages are separate and do not communicate in any way (Costa, Kovacic, Franck & Caramazza, 2003) while others support the view that the two systems interact with each other at some level of representation (Salamoura & Williams, 2007). The present study aims at shedding light on this issue. We explored how grammatical gender is processed in the mental lexicon of bilingual speakers to determine whether the gender of the native language (L1) interacts with the gender of the second language (L2) and, consequently, whether it affects the production of nouns in L2.

In addition, the processing of the Romanian grammatical gender "neuter" was studied. This gender is interesting because it features suffixes that are homophonous with the masculine in the singular and suffixes that are homophonous with the feminine in the plural. Furthermore, its theoretical status is still under debate (Croitor & Giurgea, 2009). Our goal was to determine whether "neuter" is a distinct gender in Romanian and to better understand the organization of the grammatical gender system in this language.

Romanian-French bilinguals were tested on an L2 picture naming task (Experiments 1 and 2) and an L1 to L2 forward translation task (Experiment 3). The participants had to use single nouns (Condition 1, e.g., $table_{fem}$ "table") or noun phrases (Condition 2, e.g., une_{fem} $table_{fem}$ "a table").

In all experiments and conditions, response latencies were longer for incongruent gender stimuli (e.g., the word for "pumpkin" is masculine in Romanian but feminine in French). Interestingly, the stimuli that contained "neuter" gender (e.g., "boat" is neuter in Romanian but masculine in French) yielded results similar to those of incongruent gender stimuli.

We propose that grammatical gender information is available at the level of lexical representation and that the two languages of Romanian-French bilinguals are connected in a way that allows information at this level to interact. We also propose that Romanian has a tripartite grammatical gender system.

The Representation of Polysemy in Mandarin Verbs: Chi, Da, and Xi

Huichen S. Hsiao, Yi-Chun Chen

This study investigated the lexical entry for polysemous verbs in Mandarin. Numerous studies on polysemy have focused on whether different senses of a polysemous word (nouns/adjectives) are stored separately (Klein and Murphy, 2001) or if they share a single core representation in the mental lexicon (Klepousniutou, 2001; Baretta et al., 2005; Pylkkänen et al., 2006; Brown, 2008). Unlike these previous studies, we examined the processing of varying polysemous senses of three high-frequently verbs in Mandarin: *chī* 'eat', *dǎ* 'hit', and *xǐ* 'wash', aiming at discovering (i) whether polysemous senses should be represented separately or do they share a core representation, and (ii) whether degree of sense relatedness and degree of familiarity respectively affect semantic processing time?

Thirty-eight Mandarin native speakers participated in a semantic judgment priming task. Aside from fillers, the stimuli include eighty-one verb phrases (V+NP), consisting of 27 primes (core sense) and 54 targets (3 types: basic/closely related/distantly related sense of the same verb), cf. Table 1. Participants were asked to respond to both prime and target verb phrases by deciding whether the stimuli "make sense" or not.

The preliminary results are as follows: (1) A 3 × 3 (Relatedness × Familiarity) ANOVA revealed no significant interaction between Relatedness and Familiarity, $F(2, 48) = 0.19$, $p = 0.66$, $\eta p2 = 0.004$, while statistically significant main effects for Relatedness, $F(2, 48) = 12.64$, $p = 0.00$, $\eta p2 = 0.345$, and Familiarity, $F(2, 48) = 13.37$, $p = 0.00$, $\eta p2 = 0.358$, were observed. Namely, the faster response times (RT, hereafter) were observed when target verb sense with higher relatedness to the prime sense or when stimuli that were more familiar to the subjects (cf. Tables 2 & 3); (2) Overall, post-hoc comparisons using the Scheffé Test revealed significant RT difference between each two degrees of Relatedness (p<0.01). While the main effect of Relatedness was significant within each verb, not all pairs of different degrees of relatedness had significantly different RTs. For example, RTs for stimuli constructed with the basic *xǐ* sense (742ms; SD = 97.33) were not significantly shorter than those constructed with the closely related *xǐ* senses (892ms; SD = 183.48), $p =0.17$; (3) While more than 90% of the stimuli were rated as highly familiar, Estimated Marginal Means revealed significantly different RTs between highly familiar stimuli (EMMEANS: 819ms; SE = 17.32) and slightly familiar stimuli (EMMEANS: 1436ms; SE = 120.60), $p = 0.00$, as well as between highly familiar stimuli and moderately familiar stimuli (EMMEANS: 1165ms; SE = 69.63), $p = 0.00$. Overall, the current results are in line with the single-entry view. Still, a linearly increasing progression of RTs for senses moving from the core senses, to the closely-related senses and through the distantly-related senses was observed.

Second-Language Experience Modulates Eye Movements during Bilingual Sentence Reading: Evidence from the Moving Window Paradigm

Veronica Whitford, Debra Titone

Eye movement measures demonstrate differences in first- (L1) vs. second-language (L2) paragraph-level reading as a function of individual differences among bilinguals in L2 exposure (Whitford & Titone, 2012), consistent with the weaker links hypothesis (Gollan, Montoya, Cera, & Sandoval, 2008; Gollan et al., 2011) and the Bilingual Interactive Activation Model Plus [BIA+]; Dijkstra & van Heuven, 2002). In particular, Whitford and Titone (2012) found that as L2 exposure increased, word frequency effects during L2 paragraph reading decreased— reflecting increased L2 reading fluency, whereas word frequency effects during L1 paragraph reading increased—reflecting decreased L1 reading fluency. Here, we investigate whether high L2 exposure increases L2 reading fluency and decreases L1 reading fluency using more tightly controlled sentence-level materials, and whether any L2 exposure effects relate to how bilinguals use parafoveal information to the right of fixation during L1 and L2 reading.

To this end, we used a gaze-contingent moving window paradigm (McConkie & Rayner, 1975), which allowed us to examine both global aspects of L1 and L2 reading performance (e.g., reading rates, forward saccade lengths, forward fixation durations, number of regressive saccades) and the relative size of the L1 and L2 perceptual span, that is, the amount of meaningful visual information that can be extracted during fixation.

A total of 95 L1-dominant bilinguals were tested (36 English-French, 59 French-English, aged 18-30). Stimuli were 150 short, syntactically simple, translation-equivalent sentences (75 English, 75 French), matched on key linguistic variables. The sentences were divided into five conditions which manipulated the amount of parafoveal information available to the right of fixation: four conditions with increasingly wider windows (2, 6, 10, and 14 characters) and one no-window (full text) condition. Window size to the left of fixation was held at four characters.

To address our first question, we computed a linear mixed model (LMM) for each eye movement measure examining the interaction between language (L1, L2) and L2 exposure (continuous) during full text reading. To address our second question, we computed a LMM for reading rate examining the interaction between language (L1, L2), window size (no-window vs. 2-, 6-, 10-, and 14-characters), and L2 exposure (continuous).

There were two key findings. First, bilinguals with high vs. low L2 exposure exhibited increased L2 reading fluency (faster reading rates, shorter forward fixation durations), but decreased L1 reading fluency (slower reading rates, longer forward fixation durations). Second, bilinguals with high vs. low L2 exposure were more affected by reductions in window size during L2 reading—reflecting a larger L2 perceptual span, but they were less affected by reductions in window size during L1 reading—reflecting a smaller L1 perceptual span. Of note, the perceptual span effects involving L2 exposure were significantly greater for L1 vs. L2 reading.

Taken together, these findings suggest that individual dif-

ferences L2 exposure modulate both L1 and L2 eye movement measures that reflect processes operative at fixation (i.e., foveally), and also, how attention is allocated parafoveally during L1 and L2 reading—extending Whitford and Titone's (2012) work to sentence-level materials.

Negative feedback in the acquisition of verb morphology in Russian

Elena Kulinich, Phaedra Royle, Daniel Valois

We investigate the role of the negative (corrective) feedback, subject of a longstanding debate in first language acquisition. According to some researchers (e.g. Pinker 1989, Marcus 1993) there is no effect of negative input on error correction, and the child corrects mistakes using innate mechanisms of language acquisition. However, other researchers (e.g. Saxton 1997, 2000, Saxton et al. 1998, Clark and Chouinard 2000, Chouinard and Clark 2003) show that children make use of corrections, specifically when non-conventional and conventional forms are contrasted in the conversation (e.g. Child: I *go to school. Parent: You WENT to school).

In order to check whether there is an effect of adult feedback on child error correction, or if some types of feedback are more effective than others, we conducted a series of elicited tasks with Russian children aged 3 to 4 years old. We used 12 verbs from two classes (6+6) that undergo overregularizations in the non-past tense by applying the so-called "j-correlation" model (Ceytlin 2009). This model consists in inserting a yod (/j/) in the intervocalic position at the stem/inflection boundary of the most productive Russian verb class (e.g., *chita-t'*/*chitaj-u* 'read'). Morphological overregularization errors of this type by children in early stages of Russian acquisition are quite frequent. For example, children will produce the forms **plaka***j*-*u* 'cry' instead of *pla[**tʃ**]-u*, or **vstava***j*-*u* 'stand up' for *vstaj-u*.

Verb production was tested in 35 Russian speaking children from Moscow daycares. During the task the child was encouraged to produce the present form of verbs represented as storybook pictures. The experiment was repeated during 4 sessions with two weeks time interval between the first three sessions and a four weeks interval between sessions 3 and 4. Children were randomly assigned to one of four groups. Three types of negative feedback, reformulation (with correction), clarification question and repetition (without correction), were compared with those of a control group (without feedback).

According to our hypothesis there would be an improvement in verb production (less overregularizations) in the group with explicit correction, compared to groups with clarification question and repetition, and especially those with no corrective feedback. However, the results in all four groups (including the control group) show no differences (F(3, 31) 0.57, $p > 0.1$): all children perform better in verb form production from task to task (F(1, 31) 19.41, $p < 0.001$). Larger improvements are observed between tasks 1, 2, and 3, than between tasks 3 and 4 where no changes were observed.

In conclusion, we do not observe any significant difference between effects of negative feedback type. However, the time effect suggests that interactions between an adult and a child during verb production and drawing attention to specific verbs might influence acquisition of the correct (irregular) morphological form, thus supporting the general hypothesis that feedback is not a strong driver of language acquisition.

Morphological activation during spoken word recognition: beyond sound and meaning?

Daphna Heller, Boaz Ben David

The lexicon of Semitic languages has received much attention because of the nature of morphemes in these languages. Unlike Indo-European languages where morphemes are concatenated, in language like Arabic and Hebrew (most) words are constructed by *interweaving* a consonantal root (e.g., *x,l,f*) into the vocalic pattern (e.g., *meXXaX*, yielding *me**xl**a**f** "interchange"). The lack of an independent phonological form for consonantal roots makes their status in the mental lexicon and during lexical access particularly interesting.

Research in visual word recognition has provided much evidence about the activation of consonantal roots during lexical access. Priming experiments have shown that lexical decision and naming were facilitated when the target shared the same root as the prime, as compared with priming with a visual control word that shared three letters that were not in fact the root (e.g., Frost et al., 1997 for Hebrew; Boudala & Marslen-Wilson 2005 for Arabic). Importantly, root priming was observed even when the semantic relationship between the morphologically-related words was opaque. However, this effect has not been studied in the auditory modality, i.e. during spoken word recog-

nition. It is possible that the effect observed with visual words arises from the consonantal nature of the writing systems in Semitic languages, where consonant information is highly salient because most vowels are not orthographically marked.

To examine the status of roots during spoken word recognition, we conducted two visual world eye-tracking paradigm experiments in Hebrew. On each trial, participants saw an array of four pictures and heard a single word. Participants were instructed to click on the picture that corresponded to the spoken word and their eye-movements to the four pictures were recorded. Critical trials contained the target picture, a competitor picture that was related to the target (see below), and two distractor pictures that were unrelated in sound or meaning.

Experiment 1 (n=16) examined morphological activation using displays where a "morphological competitor" shared the root with the target word, but the semantic relationship between them was opaque (e.g. target: *mexlaf* "highway interchange", competitor: *xalifa* "suit"). As a baseline for activation that is due to sound-based similarity, we used displays where a "phonological competitor" shared three consonants with the target,

but these consonants were not the root of the target (e.g. target: *sargel* "ruler", competitor: *regel* "leg"). In both conditions, target and competitor pairs did not have overlapping initial sounds and did not rhyme (the Hebrew lexicon forced a between-item design). Results showed that during the processing of the whole word, a morphological competitor – but not a phonological competitor – received more visual attention than the unrelated distractors, potentially suggesting that morphological activation goes beyond effects based on sound similarity. However, a post-hoc rating of target- competitor pairs for semantic relatedness revealed that morphologically-related pairs were rated as significantly more semantically-related (although both were rated low on the scale).

Experiment 2 (n=20) aimed to examine whether the morpho-logical effect will be retained when morphological and phonological pairs are equated on semantic relatedness (as determined by a second rating experiment). Interestingly, in this case the morphological competition effect was not observed.

Taken together, these results raise the question of whether morphological activation exists independently from the activation that is due to sound and meaning similarity (see e.g., Gonnerman & Seidenberg, 2000). Given the contrast between these results in spoken word recognition and the well-established morphological effects in the visual modality, this raises the question of whether the linear unfolding nature of spoken words shift the importance of morphological information during lexical access.

The Processing of Multimorphemic Words in Turkish: Evidence for a Dual-Route Model

Rabia Ergin, Ray Jackendoff, Ariel Cohen-Goldberg

Theories of morphological processing generally comprise three main architectures. Decompositional theories suggest that morphologically complex words are stored in terms of their component morphemes (e.g., Taft & Forster, 1975; Marlsen-Wilson & Zhou, 1999) while full-listing theories suggest that morphologically complex words are stored as wholes in the mental lexicon (e.g., Butterworth, 1983; Manelis & Tharp, 1977; Caramazza, 1997; Seidenberg & Gomerman, 2000). Between these two extremes are dual-route theories, which propose that words may be stored either as wholes, in terms of their constituents, or both.

There is now substantial evidence that both morpheme-based and whole-word representations are accessed during the reading of multimorphemic words (see Amenta & Crepaldi, 2012 for a review). Nearly all of this evidence, however, has come from Indo-European languages like English which tend to have rather simple morphological systems. This raises the question as to whether these findings are generalizable across languages or are specific to language with relatively simple morphological systems. It could be the case, for example, that whole-word storage is favored in or an exclusive property of languages that with simpler morphological systems, perhaps due to the relatively small size of the multimorphemic lexicon. The present study investigates how morphologically complex words are represented in Turkish, an agglutinative language renowned for its highly rich and regular morphology.

Following Burani and Caramazza (1987), two visual lexical decision experiments were conducted to examine how derived bimorphemic suffixed words are represented in Turkish. In Experiment 1, root frequency was manipulated while word frequency was controlled. In Experiment 2, word frequency was manipulated while root frequency was controlled. We found that in Experiment 1, subjects took significantly longer to accept words with low frequency roots than high frequency roots (725.23 ms vs. 677.51 ms, by subjects t(18) = 3.41, p=.006 and by items t(24) = 4.28, p=.014). In Experiment 2, subjects took longer to accept low frequency words than high frequency words (728.63 ms vs. 678.46 ms., by subjects t(19) = 2.19, p=.008 and by items t(24) = 4.54, p=.010). We thus observed both root frequency and word frequency effects in the processing of these words.

Our data indicate that bimorphemic derived words are both decomposed and represented as wholes in Turkish, supporting dual-route theories. While much work remains (e.g., testing larger words, words with inflectional morphology), these results suggest that joint whole-word and morpheme-based processing may be a general property of visual multimorphemic word recognition rather than a function of a language's morphological complexity.

The local-global dimension in cognitive control after left lateral prefrontal cortex damage: Evidence from the verbal and the non-verbal domain

Eleni Peristeri, Kyrana Tsapkini

Introduction

The local-global dimension (Navon, 1977) has been studied extensively in healthy controls and preference for globally processed stimuli has been validated in both the visual and auditory modalities. Critically, the local-global dimension has an inherent interference resolution component, a type of cognitive control, and left-prefrontal-cortex-damaged (LPFC) individuals have exhibited inability to override habitual response behaviors in item recognition tasks that involve representational interference (Hamilton & Martin, 2005; Novick, Trueswell, & Thompson-Schill, 2005). However, very little is known about how the local-global attentional dimension affects LPFC-damaged individuals with aphasia in language and non-language domains that involve cognitive control mechanisms.

Methods

Eight patients with damage in the left PFC and twenty age- and education-matched language-unimpaired adults have participated in the study. Non-verbal tasks included an online Global-Local Identification task (designed after Navon, 1977) asking from participants to identify global geometrical shapes, which were made up of smaller (local) geometrical configurations while inhibiting local ones, and vice versa. In congruent trials,

local and global shapes coincided whereas incongruent trials they did not. Apart from the local and global condition, the task included a mixed local-global condition, in which participants were asked to identify global and local shapes interchangeably. Participants' updating functions were independently measured by an online 2-back digit task where individuals were presented with digit sequences and were asked to respond by pressing a pre-specified key once a digit matched the digit occurring two digits earlier. The study also involved four real-time language tasks: (a) a task testing the interpretation of pronouns (Peristeri & Tsimpli, 2013) in globally ambiguous sentential contexts, (b) a task testing the interpretation of homophones in sentences requiring global processing of sentences, (c) a task testing the participants' sensitivity to local, grammatical gender conflicts of single words in a picture-word interference task, and, (d) a task testing participants' sensitivity to local orthographic violations in the stems and suffixes of single words in a semantic judgment task.

Results

In the Global-Local Identification task, LPFC-damaged patients with non-fluent aphasia performed more poorly in both accuracy (42% correct) and RTs on the local incongruent trials—where identification of the local shape presupposed inhibition of the global configuration—than any other global incongruent or congruent category. Controls were slower (but accurate) in local incongruent trials. On the other hand, PFC-damaged patients (along with controls) performed at ceiling level in the 2-back digit task, thus, indicating no deficit in their updating abilities. With respect to the language tasks, the patients performed more poorly in RTs in the tasks tapping on the integration of local cues in comparison to the tasks where conflict resolution was critically dependent on the parser's sensitivity to global context.

Discussion

Overall, the local-global dimension seems to critically influence the performance LPFC-damaged individuals with non-fluent aphasia in both language and non-language domains. A possible interpretation is that participants were able to override conflict more easily in tasks tapping on global than local processing. Broader implications for distinct types of inhibitory processes depending on the level of processing will be discussed.

An Examination of Grammar Reception in Chinese and Spanish ELLs and the Role of Heritage Programs

Ishita Aggarwal, Stephanie Wang, Joyce Mak

In multicultural countries, including Canada, English Language Learners (ELLs) struggle with second language (L2) grammar reception, a factor associated with life-long reading skills. The underlying cross-linguistic differences that influence the transfer of first language (L1) skills to L2 grammar reception are extremely important for successful immigrant integration yet have not been well studied. The purpose of this study was to provide a cross-language analysis of grammar reception for Spanish and Chinese ELLs. Two research questions were addressed: (1) Do differences exist across ELL language groups in grammar reception? (2) Are these differences explainable by various facets of heritage programs?

A cross-language analysis for Spanish and Chinese ELLs was conducted to determine whether differences in L2 grammar reception are related to L1 skills gained through heritage program participation. Grade 2 Spanish (n=87) and Chinese (n=96) ELLs from schools in the Greater Toronto Area were selected. The Test for Reception of Grammar (TROG) was administered to assess participants' grammar reception. Questionnaires provided information about L1 heritage program attendance.

Results indicated that Spanish ELLs performed significantly lower on grammar reception tasks compared to Chinese ELLs. Interestingly, Spanish ELLs spent significantly fewer hours/week in L1 heritage programs compared to their Chinese counterparts. Furthermore, Chinese ELLs tended to attend classes that involved both speaking and writing whereas Spanish students were more likely to attend classes that solely involved speaking.

Attending heritage programs may contribute to improved L2 grammar reception, particularly when the class presents both oral and written literary opportunities. It is possible that the oral component provides an opportunity for interpersonal communication skills, which have been shown to have a unique contribution compared to cognitive and academic language proficiency. It is also possible that the reading sub-skills in Chinese and English versus in Spanish and English are different. For example, in a previous study with Hebrew ELLs, the similarity in the sub-skills in L1 and L2 played a role in the transfer of the sub-skills from L1 to L2. Understanding the role of heritage programs may lessen the gap between ELLs and their native English-speaking counterparts.

How Partial Transparency Influences the Processing of Compound Words

Alexandria Stathis, Lori Buchanan

Compound words are words with multiple constituents that individually have their own meaning and that combine to make another meaning (e.g. *doghouse*). When these constituents help us infer the meaning of the whole compound word, they are known as transparent constituents (e.g. either constituent of *blueberry*). In contrast, opaque constituents do not help us infer the meaning of the whole compound word (e.g. *moonshine*).

The current study sought to describe the processing of partially transparent words, in which one constituent relates to the total meaning, whereas the other does not (like *strawberry*, which is a berry, but not made of straw).

There are two main theories of compound word comprehension: whole word processing and decomposition (Libben & Jarema, 2006). In the whole word processing model, a compound

word is represented and accessed as a whole unit, just as monomorphemic words are. In the decomposition model, however, the compound words are accessed and assembled via their two constituents. Additionally, it may not be that decomposition and whole word access are opposing processes. A number of researchers have proposed a horse race model (see Laine, Vainio, & Hyona, 1999), whereby decomposition occurs at the same time as whole word processing, with the faster method being determined by theoretically important variables, such as word presentation, word frequency, and transparency.

Previous research (Ji, Gagne, & Spalding, 2011) revealed that compound words show a processing advantage when compared to monomorphemic words on a lexical decision task. This processing advantage disappears for opaque compound words when spaces are added between the constituents. These spaces encourage decomposition as the primary method of comprehension because the constituents are already divided.

To expand on this research, the current study sought to determine whether having at least one transparent constituent would be sufficient to facilitate a processing advantage when compared to monomorphemic words under conditions of decomposition. Thirty-seven participants were asked to complete a lexical decision task in which they indicated whether an item was a word or a nonword.

Results support that the fully transparent compound words enjoyed a processing advantage when compared to the monomorphemic words. This processing advantage disappeared when any constituent (or both) became opaque. The study also revealed that partially transparent words were processed differently depending on which constituent was transparent.

Semantic Richness in Novel Metaphor Processing Stages

Hamad Alazary, Lori Buchanan

Metaphors are statements that juxtapose two traditionally unrelated words to create a meaningful relationship. They are often expressed as *A is B*, where *A* is the topic and *B* is the vehicle. We are particularly interested in understanding how people derive meaning from novel metaphors and report here a study that examines semantic variables in novel metaphor comprehension.

Structure-mapping theory holds that novel metaphors are processed by two stages; the first involves aligning the topic and vehicle and the second involves projecting the topic to the domain of the vehicle (Gentner & Bowdle, 2008). This mechanism has been confirmed in on-line comprehension studies. Wolff & Gentner (2011) presented metaphors in their forward (i.e. *some suburbs are parasites*) and backward (i.e. *some parasites are suburbs*) orientations at early (600 milliseconds) and late (1600 milliseconds) processing deadlines. Participants found forward and backward metaphors to be equally comprehensible at the early deadline; conversely, comprehension increased for forward metaphors when they were processed for a longer duration. The backward metaphor comprehension ratings decrease when participants were given longer.

The present study extends this work by examining the effects of word-level semantic characteristics at early and late stages of novel metaphor comprehension. We manipulated the concreteness (abstract vs concrete) of the topics and we manipulated the semantic neighbourhood density (high SND vs low SND) of both topics and vehicles. Thus we created four metaphor conditions: abstract topic, high SND; abstract topic, low SND; concrete topic, high SND and concrete topic, low SND. These 4 novel metaphor types were presented at early and late processing deadlines. Participants indicated if statements were comprehensible or incomprehensible.

There were main effects of concreteness, SND, and processing deadline, favouring abstract topics, low SND metaphors, and later stage metaphors respectively. An SND by concreteness interaction revealed that SND had a greater effect on concrete metaphors than abstract metaphors; a concreteness by processing deadline interaction revealed that the effect of processing deadline was greater for abstract metaphors than concrete metaphors; lastly, an SND by deadline interaction revealed that the effect of deadline was greater for low SND metaphors than high SND metaphors. The results suggest that low SND words are amenable to both alignment and projection, and are therefore fully processed and more easily assimilated into a metaphor than are high SND items. In the case of the high SND metaphors, the concreteness of the topic and the density of the semantic space of the vehicle appear to inhibit projection. This high SND inhibition can be alleviated with an abstract topic. Therefore, effective structure-mapping depends on SND, and in cases of high SND, favours an abstract topic.

Processing word combinations in a foreign language: Testing the predictions of a phraseological continuum model

Henrik Gyllstad, Brent Wolter

In the literature on the processing of multi-word units, idioms are a well-researched area. For less semantically opaque word combinations, however, there is to date relatively little work done. This study aims to fill this gap by investigating how non-native speakers of English process 'collocations' and 'free combinations'. The study draws on a theoretical approach to word combinations called the Continuum Model (Howarth, 1998). In this model, word combinations vary in semantic transparency, from the most transparent category – free combinations – through an intermediate type – collocations – to the least transparent category – idioms. Free combinations are seen as word combinations where the constituent words both appear in their literal sense (e.g. *write a letter, sing a song*), whereas collocations are word combinations where one of the constituent words is either used in a delexical or figurative sense (e.g. *pay a visit, serve a purpose*). One assumption of the continuum model is that the word combination categories have different characteristics in terms of storage and processing, but this has never

been empirically tested. The following research question was examined: *Do L2 learners process English 'free combinations' and 'collocations' differently in terms of reaction time and error rates?* We hypothesized that the processing of collocations would come with a cost and also higher error rates compared to free combinations due to a lower level of semantic transparency in collocations. A group of L1 Swedish non-native speakers of English (N = 27) and a group of native speakers of English (N = 38) as controls, all university-level students, took part in the experiment. A semantic judgement task was used to assess the participants' reaction times and error rates to items in three conditions: a) free combinations, b) collocations, and c) baseline items (consisting of semantically non-plausible word combinations). The semantic judgement task allowed for processing that taps into semantic representations, not just form (Jiang, 2012). The items were all verb + noun phrase combinations, matched for word and phrase frequency and length.

The results showed that for the non-native speaker group there was a significantly slower processing and also a higher error rate for collocations compared to free combinations. This lends validity to the distinction made in the Continuum Model for these two categories. The processing cost is believed to stem from the delexical or figurative semantic value of the verb in the collocation condition, where the relative lack of meaning in support verb constructions with verbs like *have, take and do*, and the assumed competition between literal or figurative readings for verbs like *pay, serve* and *draw* create a processing cost. The results for the native speakers mirrored those for the non-native speakers, and no significant differences were observed between the two groups. This lends support to the claim that advanced non-native speakers can process language on a par with native speakers under certain conditions. Even though the items in the two main conditions were matched for word and whole-phrase frequency based on corpus data, it is possible that subjective familiarity of the word combinations on the part of the participants may also have had an effect. We therefore collected familiarity rating data from individuals similar to those in the experiment. These data showed that the free combination items on average were rated as more familiar than the collocation items. It is therefore not unlikely that the observed processing differences in the experiment may have been driven at least partially also by subjective familiarity (see e.g. Tabossi, Fanari & Wolf, 2009).

Semantic Activation of Homophones of Japanese Kanji Compound Words in a Masked-priming Naming Task

Taeko Ogawa, Chikako Fujita

Previous studies have reported that shared phonological representations activate the different semantic representations of homophones and polysemous words in alphabetic writing systems (e.g., Hino & Lupker, 1996; Pexman & Lupker, 1999). There are a large number of homophones among kanji orthography compound words in the Japanese writing system. The purpose of this study is to investigate whether homophonous phonological representations activate different semantic representations in native Japanese speakers.

The conducted masked-priming naming study had two factors: target type (repetition, homophone, semantic associate of a homophone, and unrelated) and prime relation (primed and neutral baseline with XX prime). Thus, it first examined whether homophone effects would be observed during the early processing stages for the kanji compound words within the homophone condition, where, for example, the 電線 (/den-sen/, *electric cable*) prime was followed by the homophone target 伝染 (*contagion*). Second, the study examined whether the shared phonological representation of homophones would activate different semantic representations, and, in turn, whether the semantic activation of the homophones (伝染) of the prime (電線) would facilitate responses to a semantically-associated target 病気 (*ill-*

ness) within the semantic associate of a homophone condition.

Analyses of the RT results indicated significant main effects for target type and prime relation, as well as a significant interaction. More specifically, comparing the prime and baseline conditions, RTs in the prime condition were shorter in the repetition condition. In contrast, RTs were longer than the baseline condition in both the semantic associate of a homophone and unrelated conditions. Comparing target types, RTs were shorter in the repetition condition than in the other three conditions. Moreover, RTs in the semantic associate condition were shorter than in the unrelated condition, although no differences were observed between the homophone and unrelated conditions.

We interpret these findings as indicating that, although the prime activation in three prime conditions, apart from in the repetition condition, interferes with target processing, phonological activation of homophonous primes facilitates the semantic activation of targets that are homophones of semantic associates. As Fujita, Ogawa, & Masuda (at this conference) report a similar pattern of results for a masked-priming lexical decision task, we also discuss the cross- task comparisons between the two studies.

Cross-Script Phonological Priming with Japanese Kanji Primes and English Targets

Eriko Ando, Debra Jared, Mariko Nakayama, Yasushi Hino

Research on bilingualism attempts to understand how a bilingual's two languages are represented. In their Bilingual Interactive Activation (BIA+) model of written word recognition, Dijkstra and Van Heuven (2002) propose that representations for the two languages are stored in a shared system. The BIA+

model has pools of nodes representing sublexical orthographic and sublexical phonological information, as well as pools of lexical orthographic nodes and lexical phonological nodes. Each pool includes nodes for both languages. Although there is now a considerable amount of evidence that supports this model (for

reviews see Dijkstra, 2005; Kroll, Gullifer, & Rossi, 2013), most studies include bilinguals whose languages use the same alphabet. In the present study, Japanese-English bilinguals were tested to investigate whether the BIA+ model can be extended to bilinguals whose languages are very different. Japanese and English are different not only in their scripts, but also in phonology (Nazzi, Bertoncini, & Mehler, 1998).

A masked priming paradigm was used to investigate whether a phonological priming effect could be found between Japanese Kanji prime words and English target words. Previous studies using masked priming have provided some evidence that phonological representations for bilinguals' two languages are stored in a shared system based on the finding that target words were recognized more easily when they were preceded by a prime in another language that was phonologically similar than when it was unrelated (e.g., Brysbaert, van Duyck, & van de Poel, 1999). These findings have been extended to language pairs that use different alphabets (e.g., Dimitropoulou, Duñabeitia, & Carreiras, 2011; Gollan, Forster, & Frost, 1997; Voga & Grainger, 2007), and to pairs in which one language is a syllabary and one is alphabetic (Ando, Matsuki, Sheridan, & Jared, 2014; Kim & Davis, 2003; Nakayama, Sears, Hino & Lupker, 2012). The BIA+ model can account for these facilitatory cross-language phonological priming effects by assuming that they arise from feedback from sublexical phonological nodes to lexical orthographic nodes via the sublexical orthographic nodes. Primes in languages that use an alphabet or a syllabary are likely to activate sublexical phonological representations directly from print. However, primes in logographic scripts such as Chinese and Japanese Kanji are unlikely to directly activate sublexical phonological representations. In the BIA+ model, involvement of lexical phonological representations is likely to produce an inhibitory priming effect because lexical nodes are assumed to compete with one another. However, Zhou, Chen, Yang, and Dunlap (2010) found a facilitatory phonological priming effect with Chinese primes and English targets, which they argued that it arose from lexical phonological activation.

The present study was designed to extend Zhou et al.'s results to another logographic script, Japanese Kanji, and to explore whether the phonological priming effect was sensitive to lexical variables such as frequency and English proficiency. In Experiment 1, Kanji primes produced a significant facilitatory phonological priming effect that was uninfluenced by the English proficiency of the participants. Primes varied in length, and post hoc analyses revealed that phonological priming effects were strongest when primes consisted of a single Kanji character. In Experiment 2, only one character Kanji words were as used primes and frequency of the English targets was manipulated. Again, there was a facilitatory phonological priming effect, and the effect did not interact with target word frequency or English proficiency. These findings suggest that the facilitatory phonological priming effect for logographic primes also involves feedback from sublexical phonological representations to lexical orthographic representations. The sublexical phonological representations of the logographic primes were likely to be activated by feedback from their lexical phonological representations.

Examining the Revised Hierarchical Model with different and same-script bilingual word association response behaviour

Jon Clenton, Paul Booth

This work in progress examines word association responses to evaluate L2 developmental changes predicted by a bilingual memory model, Kroll and Stewart's (1994) Revised Hierarchical Model (RHM). The model predicts that the more proficient L2 learners are the less they rely on mediation, when compared to less proficient L2 learners. This tendency is due to the likely strength of the links between words and concepts in each of the bilingual's languages' (Kroll et al. 2010: 373). Accordingly, Kroll and Stewart's model implies that less proficient L2 learners as a tendency rely more on L1 mediation, by accessing L2 words from more readily accessible L1 translation equivalents (while more proficient L2 learners exhibit greater use of the L2-L2 link).

The current paper presents a comparison with an earlier study (Clenton, 2014), of predominantly North East Asian university student subjects, in which the more proficient L2 learners produced a greater proportion of L2-L2 links and made less apparent use of L1 translation equivalents than their less proficient (L2) counterparts. This earlier study tentatively supports Kroll and Stewart's (1994) original hypothesis. Despite this support, the first study also identified aspects in need of exploration. One such aspect relates to the orthographic background of the first study subject group (L1 Japanese, L1 Mandarin, L1 Korean, and L1 Cantonese) being different from the L2 (English). In a later critique of the RHM, and with specific comment for such subjects with an L1 and L2 that 'do not share the same written script', Kroll et al (2010: 2-3) suggest they might be expected to respond in a manner consistent with the RHM hypothesis. Accordingly, for subjects whose L1 and L2 scripts are the same, Kroll et al. (2010: 2-3) appear to imply that they might respond in a manner that is inconsistent with the RHM hypothesis.

This follow up study, therefore, explores this later claim by comparing the word association response behaviour with both different script bilinguals (the predominantly L1 Japanese from the first study) with same script bilinguals (L1 French university student subjects from the second study). The main question addressed by this paper therefore is: Do participants with the same script background respond as predicted by the RHM model or not? Our initial results appear to be more variable than Clenton (2014) and support this later claim from Kroll et al. (2010).Our aim is to present our data in full at the time of the presentation. This data has potential implications for the ways in which we view bilingual memory in view of the L1-L2 script.

Processing word combinations in a foreign language: Testing the predictions of a phraseological continuum model

Henrik Gyllstad, Brent Wolter

Frequency is known to play a crucial role in lexical access. The notions primarily discussed in the literature are *form frequency*, *(whole) word frequency* and *morpheme frequency*, e.g. *root frequency*. In numerous studies (Alegre & Gordon, 1999; Baayen & al. 2007, a.m.o.), these characteristics were manipulated to find out whether various word forms are decomposed during lexical access or are stored and can be accessed as a whole. Similar issues arise when we turn from inflection to derivation, at least with semantically transparent derivates (Niswander- Klement & Pollatsek, 2006; Taft 2004, a.m.o.).

Our study. Complex words or forms were shown to be accessed as a whole or decomposed (both options are available in some models: the one that is more efficient in a particular case wins). But the picture may be more complex in morphologically rich languages. If a word has many inflectional forms or derivates that are stored as a whole, they probably form groups, and lexical access may depend on the properties of such groups. We started exploring this question in a pilot study on Russian.

Materials. 12 triplets of unprefixed imperfective verbs and 15 pairs of unprefixed nouns. Word frequency, length and CV structure was matched inside triplets and pairs, while the summed frequency of the corresponding prefixed verbs and nouns was different for every verb and noun inside a triplet/pair. Frequency information was taken from (Lyashevskaya & Sharoff, 2009). A verb triplet and a noun pair are shown in Table 1. Participants: so far, 10 speakers of Russian (age 21-37). Method: lexical decision task, E-Prime software. Every participant saw 36 verbs and 30 nouns in Infinitive and Nom.Sg forms, and 66 nonce stimuli**Results and discussion**. We demonstrated that RTs for verbs differ significantly depending on the number of corresponding prefixed words, but RTs for nouns do not. *Prima facie*, the following explanation can be suggested: prefixed verbs are decomposed (and thus boost the frequency of their unprefixed counterpart), while the results for nouns are inconclusive. We chose deverbal nouns (to find enough relatively transparent prefixed and unprefixed ones), and, if prefixed ones are decomposed, the system should go to the prefixed verb by stripping the suffix rather than strip the prefix and go to unprefixed noun. However, we conducted a follow-up pilot LDT experiment (with other 10 participants) and demonstrated that RTs for prefixed verbs and nouns depend on their word frequency, which means that they are not decomposed, at least, not obligatorily. Thus, we opt for the following explanation. Prefixed verbs and deverbal nouns in Russian normally do not undergo morphological decomposition during lexical access. Still, prefixed verbs boost the frequency of their unprefixed counterparts because they are closely grouped in the mental lexicon, but this is not the case for prefixed nouns. We will consider several possible mechanisms (e.g. in dual route models, it can be suggested that decomposition normally does not win in these cases, but still takes place).

pair/ triplet	stimulus	word freq. (ipm)	summed prefixed freq.
verb1	*mečtat'* 'to dream'	83.6	4.7
verb1	*brosat'* 'to throw'	83.7	30.5
verb1	*puskat'* 'to let'	82.7	283.6
noun1	*terpenie* 'patiency'	22.0	16.5
noun1	*suždenie* 'judgment'	20.5	88.2

Paradigm Leveling: The Decay of Consonant Alternations in Russian

Varvara Magomedova, Natalia Slioussar

In this paper, we look at a paradigm leveling process currently taking place in Russian that affects historic consonant alternations. In standard Russian, these alternations are present in some verb forms, in comparatives, in deverbal nouns etc. (e.g. *suxoj* 'dry' – *suše* 'drier, more dryly', *ljubit'* 'to love' – *ljublju* 'I love'). However, a lot of non-standard forms lack alternations or have 'incorrect' alternations unattested in standard Russian. Unfortunately, Russian corpora contain almost no such non-standard forms, so we had to look for them on the Internet. Estimating relative frequencies of different forms found there is a challenge because the counts provided by search engines are extremely unreliable. We developed various strategies and a program to circumvent this problem. In this study, we looked at verbs and comparatives.

Verbs. Verb classes A, I, E and G-K (according to the One Stem System) have alternations in standard Russian. Out of them, the I class is the only productive one, and a lot of new slang verbs have recently appeared in it, like *frendit'* 'to include in the friend list', *kommentit'* 'to post comments' etc. This is the class with the largest number of non-standard forms, and several factors can be shown to influence their distribution. Firstly, less frequent verbs are more likely to lack alternations. Secondly, verbs lack alternation more often if they do not belong to the standard language. Thirdly, the final consonant of the stem matters: stems ending in obstruent clusters lose alternations the most often, while stems ending in labials hardly have forms lacking alternations. In the G-K class there are two kinds of non-standard forms: lacking alternations and having alternations, although there should be none. Importantly, alternation loss occurs much more often than alternation overuse although there are more forms with alternations in the present/future tense paradigm. This fact contradicts McCarthy's (2005) theory, but can be accommodated by other models (e.g. Albright, 2010). Notably, some non-standard forms have alternations unattested in standard Russian, e.g. not *d // zh*, but *d // ch, d /// sh, d // dzh,* etc. I.e. the speakers still know that there should be an alternation, but have

doubts which one in particular. **Comparatives**. For the study of alternations in comparatives two groups of adjectives were se-lected: ones that have normative synthetic comparatives with alternations (this group is not productive) and ones that do not, but native speakers still tend to generate such forms. In the first group, the process of alternation loss is more sporadic than in the case of verbs: some adjectives like *ubogij* 'poky' or *uprugij* 'resilient' have up to 30% of comparatives without alter-nations, but no significant correlation between the number of non-standard forms and lemma frequency or the last consonant of the stem could be found. The second group consisted primar-ily of compound adjectives ending in *-gij, -kij, -khij*. Analogous simplex adjectives have synthetic comparatives with alterna-tions, while these adjectives have only analytic standard forms. If speakers nevertheless try to form synthetic comparatives, they lack alternations significantly more often than in the first group. The most important factor is whether the second part of the compound is used as an independent adjective. If it is not,

as in the case of *dlinnorukij* 'long-armed' or *dlin- nonogij* 'long-legged', the majority of comparatives lack alternations. This is notable because the relevant stems with alternations can be found in many highly frequent words, e.g. *ruchka* 'small hand, handle', *nozhka* 'small leg, furniture leg'. So it seems to be crucial whether a particular form is listed in the mental lexicon, not whether the model is available. This is similar to our results with the verbs: in the I class, the model is productive, but it plays the most important role whether a standard form with alternations from a particular verb is stored in the lexicon.

The tendencies observed for comparatives were replicated in a psycholinguistic experiment

where participants (25 speakers of Russian, age 18-41) were asked to produce comparatives from various real and nonce ad-jectives (embedded in short sentences they were asked to com-plete).

Platform Session 1.3

15.00—15.20

Effects of semantic transparency on morphological processing: Prefixed English Verbs

Laurie Beth Feldman, Eva Smolka, Kit Cho, Petar Milin

15.40—16:00

Naming Errors within Families are Constrained by Semantic Category

Heidi Lorimor, Julia Buffinton, Lindsay Zajac

15.20—15.40

The fruitless effort of growing a fruitless tree: Context modulation of the processing of morpheme meanings in complex words

Simona Amenta, Marco Marelli, Davide Crepaldi

16.20—16:40

Resource Limitations and Error Monitoring During Semantic Processing

Darren Tanner, Sarah Grey, Janet Van Hell

Effects of semantic transparency on morphological processing: Prefixed English Verbs
Laurie Beth Feldman, Eva Smolka, Kit Cho, Petar Milin

We test the claim inherent to many models of word recog-nition, that processing proceeds sequentially from analysis of form to analysis of meaning, by examining patterns of mor-phological processing from prefixed English verb form primes to their unprefixed stem targets. Evidence that target latencies are significantly faster for semantically related/transparent (sublease-LEASE) than for unrelated/opaque (release-LEASE)

pairs that overlap in form challenges the claim for sequential analysis based on form devoid of semantic contributions. Stim-ulus asynchrony onsets (SOAs) are shorter than 60 ms so facili-tation is attributed to very early processing.

Many studies have investigated the role of morphological and semantic relatedness across long and short SOAs in the lexi-cal decision task (Feldman, Barac-Cikoja & Kostic, 2002; Feld-

man & Soltano, 1999; Longtin, Segui, & Halle, 2003; Rastle, Davis, Marslen-Wilson & Tyler, 2000; Rastle, Davis & New, 2004; Rueckl, & Aicher, 2008; Smolka Komlósi Rösler, 2009; Smolka, Preller, Eulitz, 2014). As a rule, form effects are robustly present even at shortest SOAs. Conversely, relatively few studies have reported reliable effects of semantic transparency when primes were forward masked and appeared at SOAs shorter than 60 ms.

On the basis of evidence for semantic effects that arise only at longer SOAs, many have asserted that processing proceeds sequentially from analysis of form to analysis of meaning. With respect to morphemes, the implication is that they are processed as units of form prior to any influence of their meanings. Effects of semantic transparency at SOAs of 48 ms and 34 ms challenge this claim, as do studies showing pure morphological effects (without semantic transparency) at long SOAs.

With only a few exceptions, the reported studies had design that could compromise their findings: (a) prime word class was not held constant; (b) different targets were used across prime conditions; and (c) many lexical covariate controls (frequencies, neighborhoods, semantics etc.) were matched on average – aggregated and contrasted over prime conditions, but not precisely equalized for individual target items matched between lists.

In the present study, all targets and primes function as verbs, all primes are prefixed, and the specification of an appropriate random effects structure controlled for differences between targets. Patterns of facilitation are examined when primes are briefly presented (34 ms) and forward masked and when unmasked and presented at 300 ms SOA. Pilot data at the 34 ms SOA reveal mean differences of 11 ms between the same target after transparent and opaque primes and are consistent with form with meaning accounts. Contributions of participants' reading and spelling differences to patterns of facilitation will be examined.

The fruitless effort of growing a fruitless tree: Context modulation of the processing of morpheme meanings in complex words
#### Simona Amenta, Marco Marelli, Davide Crepaldi

How semantics inform morphological analysis at the early stages of visual word identification has been traditionally studied through *masked priming*, yielding results that are not completely uncontroversial. The majority of the studies suggest that semantics is not a factor during early morphological analysis, but there are also data showing that semantics do affect how we process morphemes early after a complex word has been seen (Davis & Rastle, 2011).

In a move towards more ecological testing conditions, in the present study we addressed this issue in *natural sentence reading*. In particular, we exploited a feature of several derived Italian words, that is, that they can be read in a "morphologically transparent" way (as genuine derivations) or in a "morphologically opaque" way (as pseudo-derivations) *according to the sentence context* where they belong. For example, the word *copertina*, which is made up of the stem *copert-*, blanket, and the productive diminutive suffix *-ina*, can either refer to a small blanket, thus being a fully transparent derived word, or to a book/CD cover, which has clearly nothing to do with blankets.

31 of these words were embedded in sentence contexts that elicited either their transparent or opaque interpretation. By means of *eye-tracking*, we analyzed whether the effect of base word features – specifically, its context diversity (CD; Adelman et al., 2006) – changes according to whether the (*very same*) word is read as a genuine derivation vs. as a pseudo-derived word, under the assumption that stem feature effects track morphological segmentation/analysis. Crucially, we focused on first fixations so as to make sure that we were looking at early stages of processing.

A mixed-model analysis revealed a *base-word CD effect* in *both* opaque and transparent contexts, thus showing that stem were accessed independently of whether they contributed to word meaning, that is, word decomposition is indeed blind to semantics. However, while the base-word CD effect was *facilitatory* in the transparent context, it was *inhibitory* in the opaque context (see Figure), thus showing an early involvement of semantic representations. In other words, in the transparent context the word "copertina" is segmented into copert+ina and copert- act as a proper stem, thus facilitating the processing of the whole word. In contrast, in the opaque context, the word "copertina" is still segmented, but the pseudo-stem "copert-", not contributing to the whole-word meaning, actually hinders the processing of the derived form. These data are in line with evidence on compound processing during sentence reading (e.g., Marelli & Luzzatti, 2012).
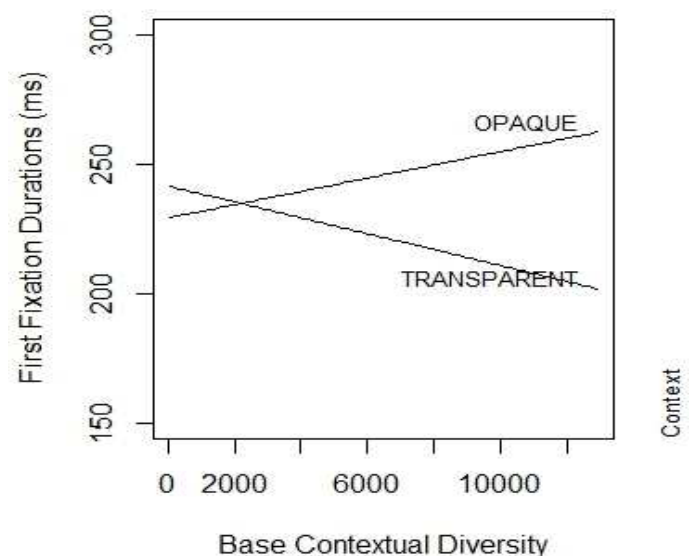
Naming Errors within Families are Constrained by Semantic Category

Heidi Lorimor, Julia Buffinton, Lindsay Zajac

To date, the cognitive processes underlying proper name retrieval have mostly been studied by inducing errors with celebrity names (Brédart & Valentine, 1992; Lucchelli, Muggia, & Spinnler, 1997), or through name-learning studies (Fraas et al., 2002). These studies have revealed how factors like semantic and phonological similarity influence naming errors. Additionally, these studies have made important strides in understanding how the retrieval of proper names, which is particularly error-prone, differs from the retrieval of common nouns (Valentine & Darling, 2006).

Errors with proper name retrieval frequently occur within immediate families. Within-family naming errors are distinct from those made in celebrity naming studies or name-learning studies, as within immediate families, the names are used frequently, and the persons being misnamed are well-known to the speakers. Griffin and Wangerman (2013) provided valuable insight into what factors influence how often parents call their children by the wrong names. However, their study was based on self-reports of errors that had occurred sometime in the past, which limited the types of conclusions they could draw.

Like Griffin and Wangerman (2013), our study investigated the types of naming errors made within families. We were specifically interested in whether naming errors would cross semantic categories, such as *relationship* (parent-child-pet) and *gen-der* (male-female), and in whether the properties of the names themselves, such as gender-specificity, humanness, and phonological similarity, would influence the likelihood of naming errors. In order to capture the errors in real-time, rather than relying on memory, we provided each family with a customized chart to record their within-family naming errors for a week.

The 57 families who participated in the study reported a total of 578 naming errors (Range: 0-30 errors per family). Statistical modeling showed that errors were more likely to be made for within-relationship and within-gender categories. Within-relationship errors were particularly common; for the 96 errors in which family members were misnamed "mom" or "dad", 91% were within the same relationship category (moms were called "dad", or vice-versa). Gender played an additional role in constraining what errors were made; of the 334 errors in which children were called by another child's name, 84% involved children of the same gender.

These results demonstrate the commonality of naming errors in families and how, within these immediate-family units, naming errors are constrained by semantic type. The study therefore informs our understanding of proper name retrieval and begins to address how naming errors within families differ from other errors in lexical retrieval.

Resource Limitations and Error Monitoring During Semantic Processing

Darren Tanner, Sarah Grey, Janet Van Hell

Electrophysiological studies of language processing have frequently implicated modulations of the N400 component as a reliable index of lexical or semantic processing. In particular, N400 amplitudes to words in highly constraining and semantically supportive contexts are reduced, relative to weakly constraining or semantically anomalous contexts. Although this pattern of effects is well-documented, there remains debate about what processes the N400 specifically indexes. In particular, some maintain that the N400 indexes semantic/lexical integration – a post-lexical access process (e.g., Hagoort et al., 2009; Kim & Lai, 2012; Kos et al., 2010; Sereno et al., 1998; Sereno & Rayner, 2003). Others maintain that the N400 is a direct reflection of lexical and semantic access from long-term memory (e.g., Kuperberg, 2007; Kutas & Federmeier, 2011; Lau et al., 2008). This picture is further complicated by the fact that N400 effects elicited by semantic anomalies are often followed by a late positive component (LPC), though variably so (e.g., in approximately 1/3 of the studies reviewed by Van Petten & Luka, 2012), though the functional significance of the LPC in semantic processing is not well understood.

Our goals in the present research were to 1) identify how N400 effects and late positivities (LPCs) to semantic anomalies are related, 2) investigate how availability of processing resources modulates engagement of neurocognitive mechanisms for lexical semantics, and 3) find evidence adjudicating between the access and integration accounts of the N400 effect. We re-corded event-related potentials (ERPs) while participants read sentences word-by-word that were semantically well-formed or anomalous (e.g., "The graphs/*hamburgers were very informative to the reader"; ERPs time-locked to "informative"). We manipulated availability of processing resources by assigning participants to one of three stimulus onset asynchrony conditions: fast SOA (225ms), medium SOA (450ms), or slow SOA (650ms). All participants performed an end-of-sentence acceptability judgment. Our hypothesis was that slower SOAs would allow for deeper lexical semantic integration of incoming words, whereas faster SOAs would trigger shallower information processing.

Results showed reliable LPC effects in all SOA conditions; however, N400 effects were only reliable in the medium and slow SOA conditions. There was no difference in N400 amplitude between the well- and ill-formed conditions when sentences were presented quickly. Moreover, there was a trade-off between the N400 and LPC effects: as N400 effects decreased, LPC effects increased. Importantly, there was no difference in overall anomaly effect magnitudes across the three SOA conditions: participants were equally sensitive to the semantic violations regardless of reading rate. Instead, SOA manipulations modulated how the anomalies were processed. Overall our results support conceptions of the N400 as an index of semantic integration, not access. Anomalies were equally well-detected across SOA levels, indicating some level of access took place. N400 effects were only found with slower SOAs, suggesting

processes reflected by enhanced N400 effects are only engaged when sufficient time/resources are available. These data argue for a model of lexical processing where lexical and semantic information becomes available early (100-300ms: Kim & Lai, 2012), followed by a stage of integration (indexed by the N400 component), with a late positivity (post 500ms) indexing error monitoring processes (van de Meerendonk et al., 2010).

Platform Session 1.4

16.40—17.00

Can We Hear Morphological Complexity Before Words are Complex?

Laura Blazej, Ariel Cohen-Goldberg

17.00—17.20

The tangled webs we weave: Can lexical priming explain the processing advantage for formulaic sequences?

Gareth Carrol, Kathy Conklin

17.20—17:40

Speeded Computation or Holistic Retrieval? An MEG Study of Lexical Bundle Processing during Picture Description

Antoine Tremblay, Anne Johnson, Elissa Asp, Timothy Bardouille, Aaron J. Newman

17.40—18.00

Blocking, competition, and the lexicon

Mark Aronoff

Can We Hear Morphological Complexity Before Words are Complex?
Laura Blazej, Ariel Cohen-Goldberg

Previous research has shown that listeners can use acoustic cues to tell the difference between phonemically identical onsets of monomorphemic words (e.g., *cap* vs. *captain*; Davis, Marslen- Wilson, & Gaskell, 2002) as well as multimorphemic *-er* suffixed words (e.g., *bank* vs. *banker*; Kemps, Wurm, Ernestus, Schreuder, & Baayen, 2005). This study investigates whether this finding 1) generalizes to multimorphemic words with other suffixes, 2) is driven by durational or other cues, and 3) is supported by item-specific phonetic information or a general rule relating duration to word length (e.g., Shatzman & McQueen, 2006). In each case, we ask whether listeners can use phonetic information to distinguish unsuffixed (freestanding words; e.g., *clue*) from suffixed words before they differ phonemically (embedded words; e.g., *clue* from *clueless*).

Experiments 1 and 2 employed a forced-choice identification task in which participants heard either a freestanding target word or the embedded portion of a suffixed word. Stimuli were extracted from sentences containing either the freestanding word (e.g., *There was a clue left...*) or the embedded word (e.g., *There was a clueless...*). Participants were asked to indicate whether the target word was a whole word or part of a longer word. We found that listeners were in fact able to distinguish freestanding and embedded words in unconstrained contexts (Experiment 1) and in a stricter context that controlled for co-articulatory cues (Experiment 2). This indicates that listeners can distinguish unsuffixed and suffixed words on the basis of acoustic information alone, before they diverge phonemically.

Experiment 3 investigated whether duration alone can be used as a cue in making this decision. To do so, unsuffixed and suffixed words were recorded in isolation. A copy of each unsuffixed word was digitally shortened to approximate the length of the root in a suffixed word. The stimuli thus contained 1) unmodified unsuffixed words, 2) shortened unsuffixed words, and 3) suffixed words (included as fillers). On each trial, participants heard one of the stimulus words and were presented with two buttons on opposite sides of the screen representing the unsuffixed and suffixed version of the word. Participants simply had to click on the button that corresponded to the word they heard and mouse trajectories were recorded. Results showed that mouse trajectories for shortened unsuffixed words deviated from the unmodified unsuffixed trajectories. Specifically, they deviated significantly towards the suffixed response op-

tion, suggesting that the shorter duration is being used as a cue that the word is suffixed. This suggests that duration alone is sufficient to indicate if a listener is hearing a short vs. long word, in this case, an unsuffixed vs. suffixed word.

Finally, Experiment 4 investigated the nature of the knowledge concerning duration. Duration information could be stored for each lexical item, in which case subjects could tell whether they are hearing an unsuffixed or suffixed word by matching the perceived duration with the stored duration for each word.

Conversely, duration could be encoded in an abstract manner such as a grammatical rule that correlates duration with longer/multimorphemic status. Experiment 4 was identical to Exp. 3 but utilized nonword stimuli, which do not have a stored lexical representation. The results were the same, indicating that listeners can make use of a general rule that relates duration to morphological structure rather than relying exclusively on stored lexically-specific duration information.

The tangled webs we weave: Can lexical priming explain the processing advantage for formulaic sequences?

Gareth Carrol, Kathy Conklin

Formulaic language (for example, idioms, binomials, clichés and collocations) has been found to be processed in a qualitatively different and quantitatively faster way than "novel" language (Libben & Titone, 2008; Tabossi et al., 2009). Strong claims have been made about what this means in terms of representation, especially for idioms, which may be represented as distinct entries in the mental lexicon as configurations (Cacciari & Tabossi, 1988) or superlemmas (Sprenger et al., 2006). Importantly, the faster processing for idioms could be due to priming, such that encountering the first word(s) of a phrase like *spill the beans* could activate the underlying entry and could facilitate retrieval of both a figurative meaning and all component lexical items. This study used eye-tracking to address two questions about the processing of formulaic language by native speakers.

First, do we see activation/priming of the whole-unit form when no biasing context is provided to aid interpretation? Previous studies (e.g. Conklin and Schmitt, 2008) have shown that in a suitably biasing context there is facilitation for known phrases vs. controls. What is unknown is whether in a minimal context encountering a phrase like *It was hard not to spill the…* will speed retrieval of *beans* compared to an equally plausible phrase like *It was hard not to drop the… (beans)*. A consistent advantage for an idiomatic form, even out of context, would support the idea that component words of formulaic sequences are linked in some way. We presented formulaic items and control items in a natural reading study, and our eye-tracking results showed consistently faster reading of words in formulaic contexts than non-formulaic contexts. This was true for idioms and also binomials (e.g. *king and queen* vs. *prince and queen*),

but not for collocations (either semantic associates like *parish church* or non-associates like *annual report*).

Our second question explored whether lexical priming could explain this effect. That is, does spill facilitate beans simply because the two words are associated through prior exposure? Again using eye-tracking, we compared natural reading times for the components of formulaic sequences used in non-canonical contexts (e.g. *I saw him spill it and the beans went everywhere*) with control items (e.g. *I saw him drop it and the beans went everywhere*). We used idioms, binomials and associated and non-associated collocations, and also included semantically related but non-formulaic items for comparison (e.g. *bread-baker*). We found bi-directional semantic priming (*bread* primed *baker* and *baker* primed *bread*) and we also saw uni-directional priming for the component words of idioms, such that spill primed beans relative to a control verb (*drop*) but *beans* did not prime *spill*. Other formulaic units did not show a comparable level of priming.

The findings of the two studies add weight to the idea that idioms, and to some extent other formulaic sequences, do have a level of representation in the mental lexicon that goes beyond individual words and associative lexical priming. The words that form idioms showed a clear advantage even when no context was available to aid prediction/top down processing, and when the components were used in non-formulaic contexts. We discuss our results in terms of the heteromorphic lexicon and usage-based models of language, and the implications for models of formulaic language/multiword units.

Speeded Computation or Holistic Retrieval?
An MEG Study of Lexical Bundle Processing during Picture Description.

Antoine Tremblay, Anne Johnson, Elissa Asp, Timothy Bardouille, Aaron J. Newman

We attempt to gain better insight into the question of whether compositional phrases are generated more or less quickly from component parts (practiced/speeded computation), whether they are stored/retrieved as wholes (lexical bundles), or both. Using the magneto- encephalographam (MEG) technique and generalized additive mixed-effects modeling, we characterize the effects of the frequency of use of single words and two-, three-, and four- word sequences on brain activity in specific regions during the pre-production stage of unconstrained overt picture description in a varied sample of the population. Our

findings suggest that (1) very high frequency bigrams, trigrams, and quadgrams may coalesce into lexical bundles (i.e., may be stored rather than computed from smaller bits), (2) longer lexical bundles are represented in a greater number of networks than shorter ones, and (3) the point where activations and frequencies shift from "increasing frequency matched by decreasing activation" to "increasing frequency matched by increasing activation " may be where lexical bundle status is apparent in activation patterns.

Blocking, competition, and the lexicon
Mark Aronoff

Given two possible words, both of which express the same meaning, how does a speaker of a language decide between them? This has been a leading question for both psycholinguistic research on the mental lexicon and theoretical morphology since the inception of modern cognitive research on the structure of words about forty years ago. This presentation recasts the question and its answer in more general terms of competition. Competition between individuals and species is a cornerstone of Darwin's theory of evolution. Competition also figures in the explanation of phenomena as diverse in scale as the solar system (Ross Taylor 2001) and neuronal development (Edelman 1987).

Fundamental to the understanding of competition in modern biology is the competitive exclusion principle of Georgii Gause (1934). This principle states that no two species with similar ecological niches can coexist in a stable equilibrium. When two species compete for exactly the same requirements, one will be slightly more efficient than the other and will reproduce at a higher rate. The fate of the less efficient species is local extinction. The principle of competitive exclusion applies broadly to any system in which two entities compete for the same resources: only one of these entities will survive locally. The principle does not predict which will survive or what mechanisms produce this result. In this presentation, I will show how the principle applies to a number of the types of longstanding problems in morphology that have preoccupied both linguists and psycholinguists since the 1970's.

The first problem that competition solves is blocking: "the non-occurrence of one form due to the simple existence of another" (Aronoff 1976, p. 43). The psychological mechanism by which blocking operates is still unknown. Early theories of lexi-

cal access saw blocking as the result of lexical entrenchment (related to frequency): a frequent lexical form like *went* blocks a rule- derived form like *goed* because it is retrieved more quickly. Later theories are also able to accommodate intermediate cases (Pinker 1999). Lexical blocking has always been seen as a form of competition (as in the many horse-race models of lexical access). What is novel here is the recognition that the competition is not specific to lexical access or even to language or cognition but that is governed by a much more widely applicable principle.

A word can escape blocking if can be used in a way that is distinct from its expected meaning: *historic* and *historical*; *economic* and *economical*. Since these words are not in competition, both can occur. Blocking is also found between rival word patterns: the English suffix pairs *-ity/-ness* and *-ic/-ical* are rivals. Competition predicts that each will find a niche. I will review evidence that this is so and that the relevant niches can be of many different sorts: phonological, morphological, syntactic, and sociolinguistic.

Gause's principle differs from previous accounts in predicting that unresolved competition (where the system has not yet settled) should be found. I will review in detail one such case, the forms of English comparative and superlative adjectives. It is well known that the language has two ways to form these, one suffixal (*quieter*) and one periphrastic (*more quiet*). Using a number of historical and contemporary corpora, I will review this phenomenon in detail and show that the distribution of the two is far from settled in present-day English and has never been settled in the written history of the language, extending over 1200 years.

Wednesday, October 1ˢᵗ

07.00 - 08.55	Breakfast
09.00 - 10.00	Platform Session 2.1
10.00 - 11.00	Poster Session 2.1 & Refreshments
11.00 - 12.00	Platform Session 2.2
12.00 - 13.00	Lunch
13.00 - 14.00	Platform Session 2.3
14.00 - 15.00	Poster Session 2.2 & Refreshments
15.00 - 16.00	Platform Session 2.4
16.00 - 16.10	Break
16.10 - 17.30	Platform Session 2.5
18.30 - 22.00	Conference Banquet (transportation provided at 18.00)

Platform Session 2.1

09.00—09.20

The Developmental Lexicon Project (DeveL): Investigating visual word recognition across the lifespan

Sascha Schroeder, Pauline Schröter

09.20—09.40

BALDEY: The Biggest Auditory Lexical Decision Experiment Yet

Mirjam Ernestus, Anne Cutler

09.40—10:00

It's not enough to look at age: the role of EF in naming among older adults

Eve Higby, Dalia Cahana-Amitay, Amy Vogel, Avron Spiro, Martin Albert, Loraine Obler

The Developmental Lexicon Project (DeveL): Investigating visual word recognition across the lifespan

Sascha Schroeder, Pauline Schröter

It is well known that visual word processing shows developmental trends: During reading acquisition, there is a strong increase in word recognition speed, reaching its peak at the end of formal schooling. After that, latencies decline slowly but constantly with age. However, it is unclear whether these age-related differences are merely quantitative changes or also associated with qualitative differences in processing (Balota & Spieler, 2000). Most computational models of the word recognition process do not address developmental factors explicitly (but see Ziegler, Perry, & Zorzi, 2014). One reason for this is that reliable data about developmental differences are still lacking.

To close this gap, the Developmental Lexicon Project (DeveL) was launched in order to examine how visual word recognition processes develop across the lifespan. In this project, 1152 German words were selected to investigate three marker effects in visual word recognition: length, frequency, and orthographic neighborhood size. These words were presented to 420 students of grades 2, 4, and 6 in computerized single sessions. In addition, data from 40 younger (20–30 years) and 40 older adults (65–75 years) were assessed. Word recognition performance was measured using the lexical decision and the naming task. To investigate the impact of interindividual differences on processing, we measured participants' reading speed, vocabulary knowledge, and non-verbal intelligence (see also Yap, Balota, Sibley, & Ratcliff, 2012).

Preliminary results showed that length effects decreased exponentially whereas frequency effects declined linearly across the lifespan. Neighborhood size showed generally weak but facilitatory effects in beginning readers, but caused inhibition in participants older than the age of 10. Thus, our data indicate that the visual word recognition system is getting increasingly more efficient with age and cumulative print-related experience might be able to attenuate some of the negative aspects of cognitive decline (see also Ramscar, Hendrix, Shaoul, Millin, & Baayen, 2014).

Data from the DeveL project will be made available to the scientific community using an online database, which allows to refine existing models of visual word recognition by conducting virtual experiments.

BALDEY: The Biggest Auditory Lexical Decision Experiment Yet

Mirjam Ernestus, Anne Cutler

This presentation will introduce and illustrate the possibilities of a new database, called BALDEY. BALDEY contains the responses from an auditory lexical decision experiment that is exceptionally large by comparison with the average 100- to 200-item protocol. Large data sets from visual lexical decision have been available for some years (e.g., Balota et al., 2007) and have proven immensely valuable in increasing psycholinguistic knowledge of the parameters that affect respondents' performance in that task and in word reading in general.

BALDEY contains the responses of 20 native Dutch listeners to 5,541 spoken content words and pseudo-words. The words vary in number of syllables and stress pattern. Besides being unusually large, the data set is also unusually representative in that most words are morphologically complex, being made up of two stems or of one stem plus derivational and inflectional suffixes, with inflections representing regular and irregular paradigms. BALDEY is publicly available.

We will illustrate the possibilities of BALDEY by discussing which frequency of occurrence measure best predicts response patterns. We observed that both accuracy and RTs were better captured by form frequencies in a very large database compiled from film subtitles (SUBTLEX; Keuleers et al. 2010) than by frequencies of forms in written text (CELEX; Baayen et al. 1995) or in spoken natural communication, both spontaneous and rehearsed (CGN; Oostdijk 2002), or by subjective ratings collected in an online experiment. We argue that the measures based on SUBTLEX outperformed the others because SUBTLEX is the largest database and because it well approximates listeners' primary language input. Importantly, however, every frequency measure captured some part of the variation that was not captured by the other measures, which suggests that each measure reflects some different part of the participant's lexical knowledge.

For lemma frequencies, RTs were better predicted by the counts given in CELEX than by those in the other sources. This result suggests that a significant part of participants' experience of lemmas comes from reading. Accuracy, however, was best predicted by a combination of the measures, possibly because, while CELEX best reflects the words and word forms known by a participant, CGN and SUBTLEX best reflect the frequencies of the word forms that often occur in informal speech.

It's not enough to look at age: the role of EF in naming among older adults

Eve Higby, Dalia Cahana-Amitay, Amy Vogel, Avron Spiro, Martin Albert, Loraine Obler

Advancing age is quite often associated with declining lexical retrieval abilities (e.g., MacKay et al., 2002). This finding has mostly been studied in terms of naming accuracy, but increasing speed of naming has also been reported (Verhaegen & Poncelet, 2013). Rather than assigning causality of these changes simply to chronological age, we asked whether certain cognitive

abilities (namely, aspects of executive functioning) are associated with lexical retrieval abilities in older adults. Executive functions are involved in several aspects of language processing including word recognition, sentence comprehension, and speed of naming (Shao, Roelofs, & Meyer, 2012; Sommers & Danielson, 1999; Yoon et al., in press). Thus, we investigated the extent to which individual differences in three different executive functions among a large group of older adults predicted their degree of accuracy and speed of lexical retrieval on an object naming test and an action naming test.

Our sample included 207 older adults aged 55-84. The naming tests administered were the Boston Naming Test (BNT) for objects and the Action Naming Test (ANT) for actions. Executive function measures were based in part on the model of executive functions proposed by Miyake et al. (2000), which includes three components: Updating, Shifting, and Inhibition. The current study included measures of Shifting and Inhibition, as well as Efficiency of Access to Long-term Memory (Access), proposed to be a fourth component of executive function (Adrover-Roig et al., 2012; Fisk & Sharp, 2004). To reduce the influence of task-specific variance, each executive function component was defined as a composite score consisting of measures from two different tasks. Shifting included the Trail-making Test and Alternating Categories fluency; Inhibition included the Stop Signal and Stroop tasks; and Access included Phonemic fluency and Semantic fluency tasks.

By itself, age was a significant predictor of accuracy on both BNT (p < .01) and ANT (p < .01), but not of response times. A multiple regression analysis was conducted to examine which executive functions predicted naming performance and whether age remained a significant predictor when executive function scores were entered into the regression first. The results of the regression showed that age no longer predicted a significant amount of the variance in naming after accounting for the effects of the executive functions. The executive functions found to significantly predict naming accuracy (after controlling for the effects of education and gender) were Shifting (both BNT, p <. 01, and ANT, p < .001) and Access (only BNT, p < .05). For response times, Access was the only executive function to significantly predict scores on both tests (BNT, p < .001, ANT, p < .05). In each case, better executive functioning was associated with greater accuracy and shorter response latencies. Inhibition did not predict any of the naming measures.

The findings support the notion that better executive functions are positively associated with lexical retrieval abilities in older adults. Different executive functions were associated with naming accuracy and response times. Shifting abilities appear to contribute to naming accuracy. Speed of naming was predicted by Efficiency of Access to Long-term Memory, demonstrating that the skilled ability to access items in long-term storage underlies both list-generation and lexical retrieval tasks. The lack of an effect of the Inhibition composite score suggests that successful lexical retrieval abilities in older adults do not necessarily depend on strong inhibition abilities (Gordon & Kurczek, 2013).

Poster Session 2.1

10.00—11.00

1. The Role of Motor-Relatedness and Priming Type in the Processing of Dutch Derived Verbs
Sophie De Grauwe, Kristin Lemhöfer, Herbert Schriefers

2. Auditory Stroop Effect with Insults and Compliments: Gender Difference in the Interaction of Semantics and Prosody
Brittany Weber, Ruth Ann Atchley, Eric Johnson, Erik Benau, Sabrina Gregersen

3. ESL lexical processing: Evidence of phonemic misperception effects
Faisal Aljasser

4. The effects of word frequency, word length, age of acquisition, and cooccurrence strength on lexical retrieval: A corpus study of Russian speech errors
Svetlana Gorokhova

5. Too frequent/obvious to notice? Tense-Aspect-Mood markers predict lexical choice best
Antti Arppe, Dagmar Divjak

6. Connected Speech Processes and Lexical Access in Real-Time Comprehension
Mercedeh Mohaghegh, Craig Chambers

7. Bilinguals see a 'scan' in 'scanner' AND in 'scandal': Masked priming evidence from English, German and Turkish
Vera Heyer, Gunnar Jacob, Bilal Kırkıcı, Harald Clahsen

8. It's All About, Like, Acoustics: Comparing Like to Like
Ryan Podlubny, Kristina Geeraert, Benjamin V. Tucker

9. Early second language learning is sensitive to the distribution of letters and sounds in first and second language words
Kailen Shantz, Juhani Järvikivi

10. Asymmetrical translation priming in highly-proficient early bilinguals
Namrata Dubey, Jeffrey Witzel, Naoko Witzel

11. Past shapes presence: language context and reversed switch cost asymmetry in Polish — English Language Switching Task.
Joanna Durlik, Jakub Szewczyk, Zofia Wodniecka, Andrzej Tarłowski, Magdalena Król

12. Garden Path Tripartite Compounds
Heather Mauch, Kiel Christianson

The 9th International Conference on the Mental Lexicon

The Role of Motor-Relatedness and Priming Type in the Processing of Dutch Derived Verbs
Sophie De Grauwe, Kristin Lemhöfer, Herbert Schriefers

There are several ways to find out whether morphologically complex derived words are decomposed or processed holistically. One possible method is morphological priming (priming between a complex word and its stem; e.g., *understand – stand*), another is 'semantic- morphological' priming (priming between a complex word and a word semantically related to its stem; e.g., *understand – sit*). Semantically transparent derived words (i.e. derived words semantically related to their stems, e.g., *koelen* 'cool' in *afkoelen* 'cool down') are usually found to be primed with both types of priming, suggesting they are decomposed. For semantically opaque derived words (i.e. derived words semantically unrelated to their stems, e.g., *springen* 'jump' in *omspringen* 'deal with'), results are mixed: Many priming studies (morphological and semantic-morphological) find no priming for opaque words, suggesting they are processed holistically, whereas results of some morphological priming studies suggest they are decomposed.

We used both types of priming with the same stimuli to find out whether type of priming influences results. In addition, we tested whether verbs of the more 'concrete' type, i.e. verbs referring to bodily movement (motor verbs), are processed differently from non-motor verbs.

In two visual priming experiments (SOA 400 ms), two different groups of 28 participants made lexical decisions on Dutch derived particle verbs. Half of these verbs contained a stem with a motor-related meaning, the other half did not. In each condition, half of the verbs were semantically transparent, the other half were opaque.

In Experiment 1, results showed an overall morphological priming effect: Particle verbs preceded by their stem were responded to more quickly than those preceded by an unrelated prime, independent of Transparency or Motor-Relatedness. With semantic-morphological priming (Experiment 2), however, only transparent motor-related particle verbs were primed by words semantically related to their stem.

The results suggest that the morphological priming method may overestimate the degree of morphological decomposition, possibly due to method-specific processing strategies, and that robust evidence for morphological decomposition of verbs exists in particular for transparent and highly concrete, i.e. motor-related verbs. This finding will also be discussed in the context of embodied cognition theory.

Auditory Stroop Effect with Insults and Compliments:
Gender Difference in the Interaction of Semantics and Prosody
Brittany Weber, Ruth Ann Atchley, Eric Johnson, Erik Benau, Sabrina Gregersen

Question: The current research was designed to determine if gender influences the size of the emotional Stroop effect when we examine auditory Stroop stimuli and employ stimuli with very strong emotional, semantic content.

Context: It is uncommon to find gender differences in the size of the classic (color word) Stroop effect (for review see MacLeod, 1991). Results using the visual emotional Stroop paradigms (participants are asked to report the ink color of neutral words [BREAD] vs. emotional words [DEATH]) have lead to mixed findings when comparing men and women.

However, it is more likely that we would see gender differences in emotional Stroop effects if we look at an auditory emotional Stroop paradigm, given that previous research has shown that males and females process prosody differently. Men have been found to be less accurate then women at identifying prosody (Plante, et al., 2006; Imaizumi et al., 2005). Imaizumi and colleagues (2005) also found that women tend to pay greater attention to prosody as compared to men, as if for women the processing of prosody is a more automatic process whereas for men it is kind of processing that requires more active engagement. The current research also adds to the literature because most of the prior research that has been done using the visual emotional Stroop and auditory emotional Stroop has used single words (i.e. DEATH or GIFT). Single words clearly can have strong emotional meanings, but an even stronger kind of emotional language is language that is directed at the listener. We used listener directed statements that were compliments or insults (i.e. "You

smell bad."), which allows us to look at how automatically this special kind of emotional semantic content is being processed. In keeping with the Stroop methods, stimuli were either congruent or incongruent. Stimuli were congruent when the prosody of the message matched the semantic valence of the message (i.e., happy tone of voice expressing a compliment). Incongruent stimuli contained a mismatch between semantics and prosody (i.e. an insult expressed in a happy tone). Across task blocks, participants were asked to either detect the prosody (happy vs. angry) or the semantic message (compliment vs. insult).

Conclusions: Overall, we found the expected Stroop effect; congruent trials were more accurate then incongruent trials. For the prosody task, we found that both a happy tone overall and particularly happy congruent stimuli lead to better performance. For the semantics task, we again found that happy tone created faster reaction times then angry tones. Regarding gender, we found that the females responded more quickly then males in the prosody task, but not in the semantic task. Finally, we found some interesting interactions involving gender in the prosody detection block. For example, men's accuracy was not influenced by the semantic content of the message when they were asked to detect prosody. In contrast, even though women were attending to the prosodic information, if the semantics were insulting they were more accurate at identifying the prosody of the message. Our results speak to both general mechanisms of emotion detection and gender differences in processing of emotional language.

ESL lexical processing: Evidence of phonemic misperception effects
Faisal Aljasser

Non-native English speakers (NNS) have been shown to act like native speakers (NS) in rating non-words that start with illegal English clusters (e.g. /dlaɪp/) less English-like than non-words that do not (e.g. /vɔɪð/) (Altenberg, 2005). This has been claimed to suggest that NNS can acquire sensitivity to English phonotactic constraints.

The current study attempted to investigate the role of first language (L1) in second language (L2) lexical processing. In other words, do NNS show more sensitivity to English phonotactic constraints if these constraints also conform to their L1?

NS of American English (N= 20) (a control group) and Arabic EFL learners (N= 40) (experimental group) participated in the present study. In the first task, they were asked to rate how

English like non-words starting with illegal clusters in English only (e.g. /dlaɪp/) and others starting with illegal in both English and Arabic (e.g. /srɑɪs/). Unexpectedly, NNS rated non-words starting with illegal clusters in English only less English-like than those starting with illegal in both English and Arabic. Similar findings were obtained when the non-words were presented in a lexical decision task. NNS rejected non-words starting with illegal clusters in English only faster than those starting with illegal in both English and Arabic. Although such findings can be claimed to be the result of NNS switching to an L2 monolingual mode, such explanation will be ruled out and phonemic misperception will be claimed to be the primary cause.

The effects of word frequency, word length, age of acquisition, and cooccurrence strength on lexical retrieval: A corpus study of Russian speech errors
Svetlana Gorokhova

The paper presents the results of a corpus analysis of 1378 Russian meaning-based noun substitution speech errors (slips of the tongue) naturally occurring in Russian normal speech. The errors were collected by tape recording and digitally record-

ing everyday conversations, telephone conversations, and live TV and radio programs.

Based on the types of conceptual-semantic relationships between the target and its substitute, the target-error pairs of

nouns were classified as either "cohyponyms" (e. g. *tram* → *bus*) or "antonyms" (e. g. *descendants* → *ancestors*) or "other" (e. g. *carpets* → *floors*) by 20 undergraduate students of linguistics from St Petersburg State University and by 4 professional linguists. The resulting error corpus under study comprised 724 cohyponym, 187 antonym, and 467 "other type" target-error pairs. The errors were analyzed for word frequency, word length, age of acquisition (AoA), target-error cooccurrence strength, and word association norms using the data from the Russian National Corpus, Russian Word Association Thesaurus, and experimentally obtained AoA ratings for target and error words.

The results indicate that in most semantic substitutions (except antonym substitutions), error words tend to be **acquired** earlier than target words while error word **frequencies** tend to exceed target word frequencies; besides, there is a very significant positive correlation between target and error frequency values. This finding runs counter to the claim that frequency is coded only at the lexeme (phonological encoding) level (Jescheniak & Levelt 1994).

Word **length** measured in syllables, while not affecting cohyponym and antonym errors, may still be a significant variable predicting the outcome of "other type" semantic substitutions: targets that elicit cohyponym and antonym errors do not differ in length from their substitutes whereas targets that elicit "other

type" errors do (their substitutes were found to be shorter than the targets).

Antonym substitutions appear to stand aloof from the other types of semantic substitution errors as targets and their antonym substitutes seem to be matched for frequency, length, and AoA.

At the same time, both antonym and cohyponym errors tend to have much higher measures of **target-error associative relatedness** and **cooccurrence strength** compared to other semantic substitution types.

To sum up, evidence from semantic substitution errors in normal speech provides support for the hypothesis that probabilistic information about lexical units may be available at earlier stages of word retrieval such as the stage of lemma retrieval. Thus, the effects of word frequency and AoA appear to play a role throughout the process of lexical selection. Word length may be another significant factor when the target competes with a non-cohyponym and non-antonym item. In antonym semantic substitutions, the effects of word frequency, AoA, and word length seem to be outweighed by the speaker's experience of frequently using the target word together with the competing antonym item (resulting in stronger associative links between the two words).

Too frequent/obvious to notice? Tense-Aspect-Mood markers predict lexical choice best

Antti Arppe, Dagmar Divjak

Frequency has long been known to be among the most robust predictors of human behaviour (Hasher & Zacks 1984). Evidence has been accumulating that frequency of exposure is an experience that drives linguistic behaviour too. Work on syntactic phenomena shows that conditional probabilities, or the likelihood to encounter Y given X, predict speaker behaviour for a range of phenomena rather well. Yet, with the exception of Bresnan (2007), Bresnan & Ford (2010) and Anonymous (2013), corpus-based studies on the relative frequencies of alternative forms for expressing roughly the same meaning, and their contextual determinants, have not typically been contrasted with experiments on the choices of native speakers with the same stimuli.

We set out to test this hypothesis for lexical semantics on the basis of a set of synonyms that express TRY in Russian and explore what type or types of contextual influence(s) the choice for one lexeme over another most strongly. Logistic regression models fit to corpus data (Anonymous 2013) showed that the markers of Tense-Aspect-Mood (TAM), often overlooked in lexical semantic studies due to their all-pervasiveness in the morphology of Russian verbs, are the strongest predictors of lexical choice. To validate this finding and test whether the

same TAM markers drive the native speakers, we ran a self-paced reading task in which 40 (20 male, 20 female) adult native speakers of Russian, aged between 18 and 30 and currently living in St Petersburg, read a number of authentic corpus sentences; these sentences contained TAM marker combinations that were found on the corpus-based model to be either typical or atypical for a specific verb. A negative correlation between corpus- based probability of occurrence and reading times for TAM marker combinations, with more typical TAM markings leading to quicker reading times, would validate the regression modelling results and indicate that native speakers are similarly sensitive to the TAM markers.

The findings are important for usage-based theories of language, as well as for deciding on the level of granularity required of a cognitively realistic corpus-based analysis. Contrary to what has been assumed, it may well be advantageous for speakers to track how frequently a particular verb is encountered with a particular morphological marker. This is expected on a usage-based approach: grammar encodes properties that are so central and pervasive that their expression has become obligatory (Janda & Lyashevskaya 2011) and this dramatically increases the frequency with which speakers encounter them.

Connected Speech Processes and Lexical Access in Real-Time Comprehension

Mercedeh Mohaghegh, Craig Chambers

The process of spoken word recognition involves the incremental mapping of speech sounds to lexical candidates. However, variability in the production of speech sounds can result in

ambiguity at the level of lexical selection. One common source of such variability is phonological processes such as place assimilation. For example, in English the place of articulation of a

coronal nasal or stop consonant can assimilate to a following labial sound, e.g., '*phone box*' is perceptually similar to '*foam box*' (/n/ -> [m]). Some studies suggest that acoustic details in the assimilated [m] partially match with both an unassimilated /m/ and an /n/, providing cues to overcome assimilation (e.g., Gow, 2002). Further, studies also suggested listeners can compensate for the effects of assimilation only when a triggering context is present (e.g., when the sound precedes a labial consonant; Gow & McMurray, 2007). The current study focuses on the nature of the factors involved in compensation for assimilation during lexical access for both nasal and stop consonants.

A Visual World methodology was used in which English native speakers viewed displays containing five buttons that were each labelled with a printed word. The labels consisted of a "prime" word (*lean*), a target word (*dine*), a competitor for the target differing only in place of articulation of the final sound (*dime*), and two unrelated distractor words. Each display was accompanied by two recorded sentences: a prime instruction (e.g., *Click on the 'lean' button*) and a subsequent target instruction (e.g., *Now click on the 'dine' button*), where the final consonants in prime and target words were each varied to be either assimilated or unassimilated. Critically, the initial sound of 'button' creates a phonological context where assimilation is viable,

entailing potential ambiguity between targets and competitors (*dine->dime*). Prime sentences were included to test if compensation for assimilation is facilitated when assimilated forms had just been heard. Expt 1 examined nasal consonants (as exemplified above) and Expt 2 examined stop consonants (e.g., '*cat' button->cap' button*).

When target words were assimilated, listeners' mouse-click responses showed some compensation for stops (53% target selections) but not for nasals (27%, p = 0.03). Further, although the mouse-click data showed no effect of priming from the first instruction, an analysis of eye movements on trials with correct responses in Expt 1 (nasals) showed that hearing a previously-assimilated form increased early saccades to target words (e.g., *dine*) within a time window focused on the final consonant and the following phonological context (/nb/; p = 0.02). However, this effect was only observed with nasals and not stops. Thus, compensation for assimilation may be less automatic than previously thought (cf. the mouse-click responses). Yet when compensation does occur, the effects seem to be more strongly tied to recent processing experiences (cf. priming) for nasals compared to stops, which may reflect the idea that contextual factors influence compensation for nasal assimilation at earlier stages of processing (Mitterer, 2011).

Bilinguals see a 'scan' in 'scanner' AND in 'scandal': Masked priming evidence from English, German and Turkish
Vera Heyer, Gunnar Jacob, Bilal Kırkıcı, Harald Clahsen

The majority of masked priming studies on the processing of morphologically complex words have concentrated on monolingual native speakers and there is currently only little research on morphological processing in bilinguals. The few studies that compared morphological priming in monolinguals and bilinguals consistently report priming effects for morphologically related prime-target pairs such as scanner – scan for both participant groups. In some studies, however, bilinguals, unlike monolingual native speakers, also showed signs of facilitation for purely orthographically related prime-target pairs such as scandal – scan, when tested in their non- dominant language. For example, Diependaele, Duñabeitia, Morris & Keuleers (2011) found significant priming effects for Spanish-English and Dutch-English bilinguals, while other studies (e.g. Silva, 2009; Kirkici & Clahsen, 2013) showed non-significant trends in the same direction. Thus, it is possible that the priming effects for morphologically related items observed in bilinguals are not morphological in nature, but are instead (at least partly) based on orthographic overlap between primes and targets.

This paper directly compares the role of morphological relatedness and of orthographic overlap in bilinguals' written word recognition testing three languages (English, German, Turkish) in a series of visual masked priming experiments. Three groups

of bilingual speakers (German- English, English-German, Turkish-German) were asked to perform lexical decision tasks in their non-dominant language. We compared priming effects for target words which were either preceded by morphologically related primes (e.g. darkness – dark; Rettung – retten '(the) rescue – (to) rescue'; sağlık – sağ 'health – healthy') or by purely orthographically related primes (e.g. scandal – scan; Schlange – schlank 'snake – slim'; devre – dev 'period – giant'). Stimulus onset asynchrony varied across experiments, ranging from 33 to 67 milliseconds.

Linear mixed-effects models on the lexical-decision times revealed that, in all three experiments, bilinguals did not only show significant priming effects for morphologically related items (all ts>1.96) but also for purely orthographically related ones (all ts>2.10). In all experiments, magnitudes of priming were comparable in size for the two items sets.

Our results cast doubt on the view (e.g. Diependaele et al., 2011) that priming effects for morphologically related prime-target pairs are in fact morphological in nature in bilinguals. Instead, we argue that, at least in their non-dominant language, bilinguals overrely on the surface form of words during the early stages of morphological processing.

It's All About, Like, Acoustics: Comparing Like to Like
Ryan Podlubny, Kristina Geeraert, Benjamin V. Tucker

The present study explores systematic acoustic variation across productions of socalled homophones. Similar to work on New Zealand English described in Drager (2011), this study focuses on productions of *like* in western Canadian English, with specific interest in how productions may differ acoustically across multiple distinct lexical and grammatical functions.

Gahl (2008) explains how words comprising homophonous pairs, such as *time* and *thyme*, are typically produced with different durations, and that such variation appears to be governed by lexical frequency. Specifically, she shows that more frequent items are produced with relatively shorter durations in spoken language, though the study does not control for possible effects of orthography. Other work indicates that word duration may also be influenced by part of speech. Dilts (2013) and Gahl, Yao and Johnson (2012) suggest partofspeech is predictive of the duration of a lexical item. For example, Dilts explains that adverbs appear most prone to reduction, nouns and verbs are relatively less reduced, and adjectives are least prone to reduction in this context, reduction is defined as both a decrease in word duration as well as any potential segmental deletion. Based on these results, we would predict that as the semantic or grammatical function of *like* changes, so too would its duration.

The data analysed for the present study were collected and extracted from ten spontaneous conversations, all of which were recorded in a sound attenuated booth while participants spoke to a friend or relative on the phone. Participants were seven female and three male speakers between 18 and 34 years of age, all of whom were native speakers of western Canadian English. In these conversations, nine lexical and grammatical functions of *like* were identified following D'arcy (2006, 2007) and Meehan (1991). Acoustic measures were extracted to compare word duration, diphthongal movement of the sequence /aɪ/, and duration of individual phonetic segments as dependent variables analysed using linear mixed effects regression (*lme4*, Bates et al., 2014). We tested these potential acoustic predictors for variation as a function of semanticsyntactic category with speech rate, speaker age, and gender as additional predictors.

We find that socalled identical homophones are acoustically rather different in production. Many of *like's* functions are adverbial in nature; in the analysis of word duration we find that most of these forms exhibit the shortest relative durations, supporting predictions based upon the work of Dilts (2013) and others. Interestingly, such adverbial use does not appear to exhibit reduced formant movement within the diphthongal sequence this negative result sits in opposition to Lindblom's description of *Target Undershoot* (1963), which argues how closely a realization approximates an idealized voweltarget is directly influenced by both temporal and articulatory constraints. Finally, contrasting adverbial use of *like*, the majority of models comparing segment duration predict relatively longer durations for the remarkably underattested lexical verb form; this and similar trends may be explained by the frequency effects described by Gahl (2008), though in this case focus lies on the phonetic components combining as relatively infrequent lexical items. Results from this study indicate speakers differentiate between homophonous forms in production. The extent to which listeners are able to capitalize on such information during lexical retrieval is largely unknown, however results from the present work support this type of temporal and spectral information as stored at the word level.

Early second language learning is sensitive to the distribution of letters and sounds in first and second language words

Kailen Shantz, Juhani Järvikivi

Recent research has found that orthography influences the acquisition and production of second language (L2) sounds and spoken-word forms (see, Bassetti, 2008). In particular, the relationship between orthography and phonology (e.g., whether a word has a consistent or inconsistent spelling) has been shown to influence L2 spoken language skills (e.g., pronunciation accuracy), even in the absence of orthographic prompts (Bassetti, 2008). The existing research that investigates how this relationship between orthography and phonology influences second language acquisition (SLA) has, however, remained limited by its inattention to possible graded effects of frequency and probabilistic measures describing this relationship.

To address this shortcoming, the present study investigates whether graded effects of orthography occur in SLA and how any such effects interact with L2 exposure. A self-paced reading-aloud task was used to elicit target word productions from native English students in an introductory German language course, and from a native English control group with no formal knowledge of German. Data from the test group were collected twice during an academic semester: Once after one month of instruction, and again after three months of instruction. Our dependent variable was the accuracy with which participants phonologically decoded written word forms to determine their pronunciation, measured as the Levenshtein edit distance between the prescribed pronunciations of the test words and the actual pronunciations produced by participants. Specifically,

we asked whether the following measures (in the first and second language) influence pronunciation accuracy and its development with increased L2 exposure:

1) The frequencies of the one-, two- and three-letter sequences in the target words

2) The frequencies with which these letter sequences occur in words whose phonological forms contain the phonemes in the prescribed pronunciations of the target words

3) The reliability (measured as delta P: see Allan, 1980) with which these letter sequences predict the phonemes in the prescribed pronunciations of the target words

Results from linear mixed-effects modeling found that the orthographic predictors described above did indeed have graded effects in SLA, as shown by their significant linear relationships with pronunciation accuracy. Results also found interactions with L2 exposure which influenced how accuracy changed over time. We interpret these results as evidence that L2 learners are sensitive to the statistical properties describing how frequently letters and phonemes occur and co-occur in the words of their first and second language, and how strongly the letters in an L2 word predict its spoken form. These findings suggest that the L2 learner's mental lexicon stores detailed information about how frequently letters and sounds co-occur in the words of both of their languages, and that this information is used during L2 phonological decoding.

Asymmetrical translation priming in highly-proficient early bilinguals

Namrata Dubey, Jeffrey Witzel, Naoko Witzel

This study investigates masked translation priming in highly-proficient early Hindi-English bilinguals. Many studies have found a translation priming asymmetry in highly-proficient unbalanced bilinguals, in which strong priming is found from L1 to L2, while weak priming or no priming is observed from L2 to L1 (see e.g., Gollan et al., 1997; Jiang, 1999; but see e.g., Duyck & Warlop, 2009). Some studies, however, have found symmetrical levels of priming in both translation directions with simultaneous balanced bilinguals (Duñabeitia et al., 2010; Wang, 2013) and L2-dominant bilinguals (Basnight-Brown & Altarriba, 2007). This pattern of results has been explained in terms of age of L2 acquisition, L2 proficiency, and language dominance. The present study tested highly-proficient early Hindi-English bilinguals (N=32), all of whom started learning their L2 English before the age of 6, in a lexical decision task with bidirectional (i.e, L1-L2 and L2-L1) masked translation priming as well as repetition priming in both L1 Hindi and L2 English. Hindi stimuli were presented in Devanagari, while English stimuli were presented in standard Roman alphabet. Interestingly, L2 English targets were responded to faster than L1 Hindi targets, which suggests that these bilinguals read more proficiently in L2 English than in L1 Hindi. Despite these bilinguals' early age of L2 acquisition and their higher level of L2 reading proficiency, masked translation priming was obtained only in the L1-L2 direction. In fact, there was no hint of translation priming when the prime was in L2 English and the target was in L1 Hindi. This was the case even though repetition priming was found in L1 Hindi as well as in L2 English, suggesting that the participants were able to process masked primes in both the L1 and L2. This set of results appears to indicate that the L1 has overriding dominance in the organization of the bilingual mental lexicon even (i) when the L2 is acquired at an early age and (ii) when reading proficiency is stronger in the L2 than in the L1. These findings will be discussed in relation to current models of the bilingual lexicon, and directions for further research will be detailed.

Past shapes presence: language context and reversed switch cost asymmetry in Polish – English Language Switching Task

Joanna Durlik, Jakub Szewczyk, Zofia Wodniecka, Andrzej Tarłowski, Magdalena Król

One of the most important questions of recent research on bilingualism is how bilingual speakers are able to select between their languages. A popular experimental tool used to investigate this issue is a Language Switching Task (LST). In LST participants are asked to name pictures or digits either in their L1 or L2 according to a provided cue (i.e. picture colour), which changes in an unpredictable manner. When no language switch is required, participants are typically faster to produce words in their L1. However, they are faster to switch from their L1 to L2 than from L2 to L1. This effect is known as an asymmetrical switch cost and is explained in terms of language activation and inhibition: the dominant L1 is more activated and it has to be suppressed more strongly when L2 should be spoken (Meuter, Allport, 1999; Bob, Wodniecka, 2013).

In the present study, we intended to explore whether language context created within experimental session may temporally modify activation pattern of participants' first (L1 - Polish) and second language (L2 - English). Three experiments were conducted which employed a color-cued Polish-English language switching task. The participants in all three experiments were unbalanced Polish-English bilinguals. In Experiment 1, participants performed LST as a first task in the experimental session; whereas in Experiments 2 and 3 LST was proceeded by five tasks in the L2. In all experiments, participants completed two blocks of the LST divided by a short break.

The results indicate that language context influenced performance in the LST. In Experiment 1, participants were faster to produce words in L1 than in L2 when no language switch was required and typical asymmetrical switch cost was observed. In contrast, in Experiments 2 and 3 a reversed language dominance was observed: participants were significantly faster to name pictures in their L2 both in switch and non-switch conditions. Post-hoc analyses revealed that the larger switch costs for the L2 were observed only in the first block of the task and disappeared in the second block in which switch cost were symmetrical. Although the effect of reversed language dominance in LST has been reported before (Costa, Santesteban, Ivanova, 2006), the reversed switch costs has never been observed in studies to date. The present data suggests that situational language context may not only reduce the level of L1 activation but also (temporarily) facilitate performance in L2 and consequently increase inhibition in L2.

Garden Path Tripartite Compounds

Heather Mauch, Kiel Christianson

Ferreira et al. (2002) proposed the theory of Good Enough processing, stating that readers of garden path sentences might not fully recover from an initial syntactic misparse. Results of Christianson et al. (2001) showed that readers often misinterpreted garden-path sentences, showing that both the misparse and the correct parse were temporarily maintained (cf. Christianson et al., 2006, 2010; Ferreira, 2003). In a related study, Tabor et al. (2004) described local coherence structures, which similarly demonstrate that sentences are comprehended locally before being comprehended globally.

The current eye-tracking study aims to expand the research on Good Enough processing to include the tripartite compound construction consisting of three nouns, where the second constituent is a homonymous verb-derived noun (see below).

(1) a) Last week, the obese dog bite victim met the neighbor for coffee.

b) Every weekend, the obese dog bite victim meets the neighbor for coffee.

c) Last week, the neighbor met the obese dog bite victim for coffee.

d) Every weekend, the neighbor meets the obese dog bite victim for coffee.

Subjects will read sentences as in (1) as their eye movements are being tracked. Participants will be asked "What was (adjective)?" after reading the target sentence (e.g. "What was obese?" with choices being "the dog" or "the victim."). The initial partial, ultimately incorrect interpretation is that the dog is obese. Furthermore, if this interpretation is pursued, the absence of a past tense (1a) or 3rd-person agreement (1b) marker on the middle constituent should generate an immediate error signal, as reflected by inflated fixation durations on the faux verb. In addition, there should be evidence of syntactic reanalysis on the main verb (meets/met), i.e., inflated re - reading times on the previous sentence regions. These error signals should be absent in (1c-d), as the object position should rule out the main verb misinterpretation of the second compound constituent. However, if the 'NVN = SVO' heuristic proposed by Townsend and Bever (2001) operates despite previous syntactic context ruling it out as a possible continuation, then error signals should arise similar to when the tripartite compound is in the subject position (i.e., inflated fixation durations on "bite" and re-reading when encountering "victim"). Such a pattern would be consistent with previous 'local coherence' literature, and also suggestive that surface order heuristics apply despite the acceptability of the global syntactic frame. Finally, if participants often incorrectly answer comprehension questions, this will provide further evidence for Good Enough processing, suggesting that the reader temporarily maintains both the correct and initial incorrect interpretations of the sentence, and that maintaining these conflicting interpretations interferes with the generation of a single coherent interpretation. Tripartite NVN compounds thus represent a heretofore under-explored tool to examine processing that requires the reanalysis of phrasal structure into single lexical heads, and thus straddles both lexicon and syntax.

Disambiguating Models of Idiom Comprehension: Context Effects on Figurative and Literal Meaning Retrieval

Nyssa Z. Bulkes, Christopher M. Grindrod

Current psycholinguistic research provides evidence for a number of competing views of how we understand nonliteral language, such as idioms (e.g., *a slap in the face*). The *noncompositional view* suggests that idioms are represented and retrieved from the lexicon like long words (Bobrow & Bell, 1973; Gibbs, 1980; Swinney & Cutler, 1979). In contrast, the compositional view suggests that like literal language, comprehenders decompose idioms into their component parts and use this semantic information to arrive at the intended interpretation (Gibbs & Nayak, 1989; Nunberg, 1978). Finally, the *hybrid view* incorporates aspects of the two previous views, arguing that the more familiar or predictable an idiom is, the easier the figurative interpretation can be retrieved from the lexicon (Libben & Titone, 2008; Titone & Connine, 1999). Given the large amount of research on idiom comprehension, it is surprising that few studies have investigated how contextual information impacts literal and figurative meaning retrieval. Understanding the role of context during the comprehension of multiword expressions is important for building models of nonliteral language comprehension. To address this issue, the present study investigates whether contextual information facilitates retrieval of the contextually appropriate meaning of idioms with figurative and plausible literal interpretations.

In the current study, 49 younger adults were presented with familiar ambiguous idioms in contexts biased toward either the literal or idiomatic interpretation. In a cross-modal semantic priming paradigm, participants listened to idiom-biased sentences ending in ambiguous idioms (e.g., *The couple had been together for several years so they decided to tie the knot.*) or literal- biased sentences (e.g., *The friends had noticed the sail coming loose so they decided to tie the knot.*) and were then asked to make a lexical (i.e., word/nonword) decision on a visually- presented target. Word targets were related to either the idiomatic (e.g., *marry*) or literal interpretation (e.g., *rope*) of the sentence-final phrase, or were semantically unrelated (e.g., *steal/beef*). Participants' reaction time and accuracy were recorded.

If an idiom is retrieved like a long word from the lexicon, in agreement with the noncompositional view, then priming should only be observed for idiom-related targets following idiom-biased contexts. In contrast, according to the compositional view, priming should be observed for both idiom-related targets in idiom-biased contexts and literal-related targets in literal-biased contexts, as this would suggest literal and nonliteral language are represented and retrieved in a similar manner from the lexicon. Further, if context facilitates lexical access, priming should be obtained only for targets that are contextually appropriate.

Results showed significant priming for idiom-related targets following sentences where the idiom was used figuratively, as well as for literal-related targets following sentences where the idiom was used in either the literal or figurative sense. A lack of priming for idiom-related targets following literal-biased contexts suggests that idiomatic and literal interpretations are not pursued in parallel. Rather, our results support the compositional view of idiom comprehension, in that a rich context has the ability to override the dominant figurative meaning of a familiar idiom and facilitate direct retrieval of only the most contextually appropriate interpretation. Based on these findings, we argue in favor of an extended view of idiom comprehension that underscores the importance of contextual cues in processing expressions with both figurative and literal interpretations.

The relationship between cultural/conceptual and form properties of Dutch words

Agnes Tellings

In previous research we found seven word groups (700 words in total), differing regarding their configuration of scores on Age of Acquisition (AoA), Mode of Acquisition (MoA), Imageability (Ima), Familiarity (Fam), i.e. conceptual&cultural properties (c&c-properties), and freqency, length, family size, and word class (Tellings, Coppens, Gelissen & Schreuder, 2013). Elementary school children scored differently on tasks with words from these groups. Five groups contained highly similar words regarding linguistic form: two groups only contained derivationally complex words, one almost only monomorphemic words, two others almost only monomorphemic words and inflected stems. This was striking, since morphological complexity was not a word property on which the division into word groups was based. These results prompted us to investigate the relation between c&c-properties and linguistic form properties.

First, we tagged the 700 words for number of bound morphemes, number of free morphemes, and total number of morphemes. Significant correlations were found between the c&c-properties and the form properties, mostly between .3 and .5. Second, we analyzed three data sets, i.e. scores of elementary school children on language tasks with a subset of the 700 words (N=207 words), for which sets we previously had found that scores differed for the seven word types. We did regression analyses with the c&c-properties and the form properties to examine which explained the most variance in the children's results. Third, we did an experiment that is still running. We made pseudowords from the 207 words, retaining affixes, conjugations, inflections, number of consonant clusters, and the length of the word. We ensured that the new part(s) were no Dutch morphemes and resembled as little as possible the original word both phonologically and graphically. So the word *vermalen* (to grind), consisting of the affix *ver-*, the stem *maal*, and the conjugation *–en* became: *verdezen*. We asked 25 university students to rate the pseudowords on AoA as words that "do not exist in Dutch but could exist". We will compare the results with the AoA scores of the original words. A similar study has been performed by Reilly, Westbury, Keen & Peelle (2012) yet their participants heard the words instead of reading them, and answered yes/no-questions on concreteness instead of rating the pseudowords on AOA.

Understanding better how conceptual/cultural and form properties cohere, or do not cohere, in words, and how language users deal with them, is important both for language processing research and, more in general and methodologically, for deciding which (combination) of word property variables to select for psycholinguistic research.

Regular, sub-regular and idiosyncratic French verb production by first language and multilingual children

Alexandra Marquis, Marie-Josée Poulin, Ariane St-Denis, Phaedra Royle

We addressed whether children learning French as a first language (L1) are sensitive to sub-regular verb conjugation patterns (i.e., neither default, nor idiosyncratic) (e.g., Albright, 2002; Clahsen, 1999). In addition, we tested whether children with other first languages than French (MUL) have more difficulty learning these patterns due to their lesser exposure to the language (Nicoladis, Palmer, & Marentete, 2007). We hypothesized that L1 and MUL children learning French would process verb inflection patterns differently based on their default status (-*er* verbs), and reliability (e.g., sub-regular -*ir* verbs), with MUL children showing weaknesses in non-default types (Royle, Beritognolo, & Bergeron, 2012).

We elicited verbs in 169 children (aged 67 to 92 months) attending preschool (n = 105) or first grade (n = 64), who were L1 or MUL learners of Québec French, using 24 verbs with regular, sub-regular, and irregular participle forms (6 each, ending in /e/, /i/, /y/ or *idiosyncratic*) in the *passé composé* (perfect past). Using our Android application *Jeu de verbes*, verbs were presented with images (see Figure 1) representing them in infinitival forms (infinitival complements or the periphrastic future, e.g., *Marie va cacher ses poupées* 'Mary AUX hide-INF her dolls' = 'Mary will hide her dolls') and present tense contexts (e.g., *Marie cache toujours ses poupées* 'Mary hide-3SG always her dolls' = 'Mary always hides her dolls'). Children were prompted for target verb forms in the *passé composé* by answering the question 'What did he/she do yesterday?'.

Preliminary analyses (n = 60) reveal higher target production in the first grade and no differences between language (L1/MUL) groups. Response patterns highlight morphological productivity and reliability effects (/e/ > /i/ = /y/ > *idiosyncratic*) on children's mastery of French conjugation. Only subtle differences are found between language groups in error patterns. In depth analyses comparing all 169 children including language group should further inform us on children's mastery of French *passé composé*, while non-parametric analyses on frequency of response types should reveal a clearer picture of children's response strategies by verb or language group.

Contrary to expectations, both language groups appear to show strengths on default patterns and sensitivity to sub-regular verbs, including those with the final /y/ vowel, which are considered non-productive (e.g., Royle et al., 2012). These data show that even though they have lesser exposure to oral French language, MUL children rapidly master verb conjugation patterns to the same level as L1 children in immersive (school) contexts.

On the Processing of Partial Subject-Verb Agreement in Arabic: An ERP Investigation
R. Muralikrishnan, Ali Idrissi

Plural subjects in Arabic are idiosyncratic when it comes to verb agreement. They require full agreement (Person, Number and Gender) in the subject-verb (SV) order, whereas in the verb-subject (VS) order, verb agreement should be partial (Person and Gender only) when the subject is overt, but full if the subject is dropped. A sentence-initial plural verb per se does not constitute a violation, insofar as the subject is dropped in the unfolding utterance. Thus, the Number feature has a significant syntactic role in Arabic, in that it interacts with word-order in a complex way, requiring different agreement patterns depending on word-order and whether or not the subject is overt. Simply put, what would be correct under certain conditions is unacceptable in others. The processing system must therefore take this idiosyncrasy into account in order to process an unfolding Arabic sentence in real time successfully. In an effort to understand the neural mechanisms that make this possible, we conducted three visual ERP studies, the results of which we discuss here. Participants judged the acceptability and performed a probe task after each trial.

Experiment 1 involved SV intransitive sentences, with singular or plural subjects. The verb either agreed fully with the subject or it violated one of the agreement features or tense. All violations at the verb evoked an N400-P600 as opposed to the control condition. Sentences with singular subjects evoked an additional LAN effect, thus providing initial evidence that agreement is processed for singular versus plural subjects qualitatively differently in Arabic.

Experiment 2 examined whether the processing system treated violations of P vs. N vs. G differently based on subject-type. ERPs at the verb showed a graded biphasic pattern differing between subject-types, with the Number feature evoking the largest effects – thus least violable – in either subject-type. These results suggest that, whilst the Feature Hierarchy Hypothesis holds true, the exact hierarchy is rather language-specific. The differential graded effects in both the N400 and P600 time-windows indicate that each feature is assessed differentially when processing Arabic agreement, both in early and late stages. Acceptability data showed that agreement violations involving plural subjects are treated as less severe, thus more acceptable, providing further evidence to the differential prominence of the agreement features in Arabic.

Experiment 3 employed intransitive VS sentences; the verb was either singular-marked or plural- marked, but otherwise always agreed in Person and Gender with the forthcoming subject, which was either singular or plural. No ERP differences ensued at the verb. ERPs at the subject and the subsequent adverb (identical in all our stimuli) suggest that the processing system did not conclude sentences to be globally anomalous until conclusive evidence (end of clause) arrived.

Taken together, our results suggest that the presence of partial agreement in a given language might require the processing system to be globally sensitive about the fact, even in cases when conditions for partial agreement are not met, in order for it to cope with the idiosyncrasy.

Lexical Representation of Free Variants - On the Effect of Orthography on Word Learning
Chung-Lin Yang, Isabelle Darcy

Exposure to L2 orthography may help L2 learners distinguish a novel segmental (e.g., Escudero, Hayes-Harb, & Mitterer, 2008) and tonal contrast (Showalter & Hayes-Harb, 2013). In general, previous studies examining the benefit of orthography on speech learning mainly investigated whether L2 learners can become better at distinguishing an unfamiliar contrast based on the corresponding orthographic forms. However, little is known about whether learners can associate two phonetic variants with the same lexical entry when the orthographic form of the word is provided during learning. In the current study, learners were to learn an invented language where [ɔ] – [u] (both can be spelled as <o>) were in free variation (test condition) while [e] – [a] were contrastive, and spelled as <e> vs. <a> (control condition). Our specific research question is: Can orthographic information help L2 learners associate two free variants (e.g., <fosat> for both [fɔsat] and [fusat]) with one single lexical entry (e.g., 'desk')?

In Experiment 1, we used a word learning paradigm modified from Hayes-Harb, Nicol, and Barker (2010). In the familiarization phase, Taiwanese and American subjects were auditorily presented with words paired with pictures and told that some words may have more than one pronunciation. In the learning phase, participants learned a set of new words where some

test and control items were only presented in one form (e.g., [fusat]). In addition, in both familiarization and learning phases, one subgroup of subjects saw the spellings when they heard the words ("Orth+"), while another did not (i.e., auditory only, "Orth–"). Finally in the testing phase - a picture-auditory word matching task - the words they learned in the learning phase were presented as another variant (e.g., [fɔsat]). Subjects who learned that the variants were allophonic were expected to link the two variants to one single picture in the test condition only, but not in the control condition. Specifically, we predicted that Orth+ would detect the alternation more readily and learn the free variation better than Orth–. The results showed that Taiwanese Orth+ responded significantly faster on the control condition than Orth– (p = .002), suggesting a possible advantage in processing when orthographic information was available. But no significant difference between Orth+ and Orth– in accuracy was found on all three conditions: test, control, and baseline (words not involving alternations).

In Experiment 2 (a picture naming task), subjects were asked to name the pictures they learned in Experiment 1. The results showed that both Taiwanese and American Orth+ subjects produced significantly fewer wrong vowels for the minimal pair items (control condition) than Orth–. For example, for the word

[gekaf], Orth– tended to produce [gakaf], suggesting that they did not learn that [e] – [a] were contrastive. Also, American Orth+ subjects produced more new tokens of the free variants as well as the original tokens learned in the learning phase than Orth–.

In conclusion, Orth+ learners may have encoded the orthographic information in the mental lexicon. But in the picture-word matching (recognition) task, when presented with a new token of the item learned previously, learners were more tolerant in accepting the new token of the item (both test and control) as the correct auditory label for the picture (i.e., high response bias toward "yes" responses), and orthographic information did not play a significant role in the picture matching decision process. However, when asked to name the pictures spontaneously (instead of judging if a new token was an acceptable label for the picture), orthography did help learners retrieve and produce more correct forms of the words. In sum, our findings suggest an important role of orthographic information for L2 word learning.

The influence of noun classifiers on the lexical processing of compounds: Evidence from real-time spoken word recognition in Cantonese

Cara Tsang, Craig Chambers, Mindaugas Mozuraitis

Many languages contain *noun classifiers*—grammatical elements that co-occur with nouns and which specify a subcategory to which the corresponding noun belongs. These forms are typically abundant, and the nature of the pairings between classifiers and nouns is complex and often described as semantically redundant for certain classifier types. Given the acquisition challenges entailed by a large classifier inventory, and the extra requirements they impose on language production and comprehension, it is relevant to ask what kind of functions they might serve. The current study explores a processing-oriented answer to this question by investigating how Cantonese noun classifiers reduce the extensive indeterminacy in on-line processing that arises from the high proportion of *compounds* in the language's noun inventory (80 to 90%).

A visual world methodology was used to examine Cantonese listeners' incremental interpretation of noun phrases containing classifiers. On critical trials, the name for the depicted target object mentioned in a recorded instruction initially overlapped with name of a depicted competitor object, with the extent of overlap being varied across three conditions. In the *target compound* condition, the name of the target was a compound in which the initial constituent corresponded to the name of the competitor (similar to English *bookbag* vs. *book*). In the *competitor compound* condition, the reverse situation held, i.e., name of the competitor was a compound in which the initial constituent corresponded to the target noun (thus the target name was fully embedded within the competitor name). In the *both condition*, the target and competitor names were both compound nouns, overlapping in their initial constituent but distinct thereafter (similar to English *bookbag* vs. *bookcase*). A second manipulation varied the informativeness of the classifier that immediately preceded the noun. In the *nonconstraining* condition, the grammatically-specified classifier for the target name was the same as the classifier for the competitor name. In the *constraining* condition (i.e., the more normal circumstance given the composition of the lexicon), the respective classifiers differed. As such, the classifier could provide a grammatical cue that could arguably damp the activation of the competitor as the target noun is heard.

Fixation patterns measured as the target noun unfolded showed considerable visual consideration of the competitor object in conditions with nonconstraining classifiers, reflecting sustained co-activation of the competitor name along with the target name, seriously delaying the point where the target form was selected over the competitor name. Interestingly, a significant lexical garden-path was observed in the target compound condition whereby the (shorter) competitor name was initially considered more strongly than the target name, suggesting that processing mechanisms at this level are not retuned by certain statistical aspects of the lexicon as a whole (e.g, in view of the fact that a bias to expect a compound form would arguably be more adaptive in a compound-dominant language). Importantly, the activation of the lexical competitor was markedly reduced in conditions with constraining competitors, and the effect was greatest for the conditions that showed the strongest activation of the lexical competitor when the classifier was uninformative. Together, the results appear to confirm that classifiers provide considerable value for real-time processing by attenuating the strong lexical competition that otherwise arises from rampant compounding in the Cantonese noun lexicon. The streamlining effect of classifiers in unconscious aspects of auditory comprehension therefore seems to supplement any semantic or grammatical function these forms may serve within the language's combinatorial system.

Why a farm is transparent and a fruit is opaque: The "stem transparency" effect explained

Marco Marelli, Simona Amenta, Davide Crepaldi

A largely overlooked side result in most studies of morphological priming is a consistent *main effect of semantic transparency* across priming conditions. That is, participants are faster at recognizing stems from transparent sets (e.g., farm), in comparison to stems from opaque sets (e.g., fruit), *regardless* of the preceding prime types (e.g., farmer vs. fruitless vs. unrelated primes). This suggests that the semantic transparency of the derived form may be also consistently associated with some property of the stem word.

We propose that this property might be traced back to how well we can predict the meaning of a word on the basis of its orthography. WIDOW, to illustrate, has a very informative form, because it is related in meaning with any word in the English lexicon with the same onset (WIDOWER, WIDOWED, WID-

OWHOOD). Conversely, WHISK is a less informative orthographic chunk because its original meaning is not retained in orthographically similar words (WHISKEY, WHISKY, WHISKERED, WHISKER). We name this property Orthography-Semantics Consistency (hence, OSC). In the present study, we exploit distributional semantic models to quantitatively characterize OSC, and test its effect on visual word identification relying on large-scale data taken from the British Lexicon Project (BLP, Keeulers et al., 2012).

We first confirm the reliability of the "stem transparency" effect by showing that it holds when testing 335 stems taken from previous masked priming studies on the BLP data (Experiment 1).

In Experiment 2, we proceed to compute OSC. For each item used in Experiment 1, we extract all the words with a similar onset, forming a family of "orthographic relatives". Using distributional-semantics methods (Turney & Pantel, 2010), we automatically generate the semantic similarity between a stem and each of its orthographic relatives. We finally compute OSC as the frequency-weighted average semantic similarity. The resulting OSC measure has a significant effect in the expected direction: stems taken from transparent sets have significantly higher OSC than stems taken from opaque sets, and OSC has a facilitatory effect on BLP latencies in lexical decision.

Finally (Experiment 3), we show that OSC has a general effect in visual word recognition by testing it on 1821 words randomly selected from the stimuli included in the BLP database. Also when considering this large set of items, the effect of OSC on lexical decision latencies is significant.

In conclusion, results indicated that (a) the "stem transparency" effect is solid and reliable, insofar it holds in BLP lexical decision times (Experiment 1); (b) an unbalance in terms of OSC can account for it (Experiment 2); and (c) more generally, OSC explains variance in a large item sample from BLP, proving to be an effective predictor in visual word access (Experiment 3).

Neural measures track subphonemic processing during spoken word recognition

Samantha Kramer, Anna L. Moro, John F. Connolly

Spoken language is produced with a great deal of variability with which listeners must be able to cope. One source of variation is coarticulation, due to articulatory planning and transitions between segments. One study had speakers listen to words identify the coda consonant in a forced-choice paradigm. Coda consonants were either identity- or cross-spliced, so that transitions from nucleus to coda carried congruent or incongruent coarticulatory cues. Results showed significantly longer reaction times when cues were incongruent. Due to the rapid, temporally dynamic nature of coarticulation, it is valuable to use online measures to study this phenomenon.

Recently, the temporal features of coarticulation were investigated during a picture/spoken-word matching task that manipulated words by using spliced stimuli carrying either congruent or incongruent subphonemic cues at the C-V juncture. ERPs were recorded with particular attention paid to the *phonological mapping negativity* (PMN) – a prelexical response sensitive to violations of phonological expectations that onsets and peaks around 230 ms and 300 ms, respectively. Results found that the PMN varied in response to coarticulation violations and concluded that phonetic features in spoken words influence prelexical processing during word recognition.

The need to use imageable words in the paradigm meant that vowel and word onsets were not normally distributed (e.g., most onsets were fricatives with some nasals and affricates). The consequence being that the spoken words were not controlled for temporal and acoustic features. Using a written-/spoken-word paradigm, a recent study controlled phonological shape by using onsets that were either fricatives or stops, hypothesizing that coarticulatory information would be processed faster to stop than fricative onsets due to their temporal differences. All stimuli were CVC, ensuring the transition from onset to nucleus was misleading with regards to vowel identity in cross-spliced tokens. Vowels were one of /i, u, æ, ɑ/, maximizing acoustic distance (height and backness). Findings supported the PMN's sensitivity to coarticulation but also showed that temporal/physical differences between fricative and stop onsets modulated the effect with faster processing of stops and easier detection of low than high vowels.

These results raise the question of whether acoustic distance between vowels will modulate prelexical processing of speech as reflected by the PMN amplitude: the focus of the current study. Words were organized into minimal sets such that all onset/coda combinations appeared with each vowel provided that English words resulted. Data from 16 subjects indicate that the PMN is sensitive to the *degree of difference* between the original and post-splice vowels. When the number of distinctive features changing is greater, the result is an earlier, more robust PMN. This suggests that the rate of speech recognition is not static but dynamic, and is dependent on likeness of subphonemic features.

Testing the Cognate Facilitation Hypothesis Through an Offline Lexical Decision Task

Maria Claudia Petrescu, Rena Helms-Park, Vedran Dronjic

The Cognate Facilitation Hypothesis posits that when formal similarities between L1 and L2 lexical items coincide with semantic overlap between these items, L2 lexical acquisition is facilitated (de Groot & Keijzer, 2000; Davis, Sánchez-Casas, García-Albea, Guasch, Molero, & Ferré, 2010; Hall, 2002; Kroll & Stewart, 1994; Midgley, Holcomb, & Grainger, 2011). The study being presented here is part of a larger project in which established L2 lexical test formats (lexical size, lexical depth, and offline lexical decision) were used to test for cognate facilitation in various frequency bands and registers. The experimen-

tal group consisted of speakers of Romanian, a language with a Latinate lexicon which includes a substantial proportion of cognates with English. The control group consisted of speakers of Vietnamese, a language with only a few phonologically nativized borrowings from French and English. Romanian and Vietnamese share a Latinate script, eliminating the confound of script. Cognates were defined psycholinguistically, as words with phonological and semantic overlap (Carroll, 1992).

English data have been collected from 57 undergraduate speakers of Romanian (n = 33) or Vietnamese (n = 24) via a newly designed offline lexical decision test created to assess cognate facilitation effects. The test contained 138 mixed-frequency items, of which 40 items were "real" cognates (semantically and phonologically overlapping); 17 items were "quasi-cognates" (partially overlapping in meaning); 21 items were "misleading cognates"; 20 items were pseudo-cognates (as defined by Hall, 2002, e.g., Romanian *anormal* for *abnormal*); 20 items were non- cognate real words; and 20 items were non-words words that did not resemble Romanian- English cognates. The central question was what type of facilitation effects could surface in an offline lexical decision test of the type typically used in L2 contexts (e.g., in placement testing).

Our results indicate that the Romanian group outperformed the Vietnamese group in the recognition of only those cognates that were both (i) translation equivalents and (ii) with formal overlap that met certain established criteria (e.g., Roberts & Deslauriers, 1999). This advantage disappeared for word pairs with only partial semantic overlap (irrespective of form) as well as for all of the distractors. Our initial interpretation is that (i) items with incomplete overlap in meaning (and sometimes also form) receive less activation in processing; (ii) that advanced-level Romanian speakers of English are cautious in their approach to cognates; and (iii) that items that are formally very similar to known English words are blocked as potential L2 lexical items (e.g., pseudo-cognates such as anormal). Interestingly, the Vietnamese speakers also excluded such pseudo-cognates to the same extent, possibly for the same reasons as the Romanians' or because these were not attested in the input.

In summary, our findings highlight the lexical advantages that cognates bestow on advanced- level learners with related L1s and L2s, especially in the case of lexical decision tests. However, in this study at least this advantage was seen only when there were very high levels of semantic and formal overlap between cognates. We recommend that learners' performance on cognates and non-cognates be considered both together and separately. In further research, we intend to use online lexical decision (reaction) times and test the cognate facilitation hypothesis with discrete visual and auditory stimuli.

Individual differences in affective reactivity predict reading speed
Chris Westbury

Various studies have previously shown that the affective content of text affects reading speed. Cupchik, Leonard, Axelrad, and Kalin (1998) asked participants to read excerpts from short stories in a self-paced reading paradigm. They found that the emotional excerpts were read more quickly than the descriptive excerpts. Similar results were found by Cupchik and Lazlo (1994). Recent evidence (Westbury, 2013) has shown that judgments of the subjective familiarity of words are affected by individual differences in affective reactivity, as measured with the Behavioural Inhibition System (BIS) and Behavioral Activation System (BAS) scales (Carver and White, 1994). People who score higher on these measures of affective reactivity rate words as being more familiar, suggesting a close relationship between lexical access and the affect system.

We replicate the work on emotional text reading using computed estimates of lexical emotionality derived from a co-occurrence model. Experimental participants read texts rated as more emotional more quickly than closely-related texts rated less emotional. We then extend the work by directly manipulating individual affective reactivity, selecting participants on the basis of their BIS & BAS scores. Readers with greater emotional reactivity read extended texts and make lexical decisions more quickly than those with less emotional reactivity. A comparison of the effect of affective reactivity on reading to its effect on a non-linguistic (spatial rotation) task suggests that the effect is not due only to a general reactivity-related speed effect. We argue that the large effects of affective reactivity seen in reading and lexical decision specifically reflect differences in semantic processing, and discuss some implications of this claim.

Conceptual and phonomorphological grammatical gender assignment in French:
Lexical architecture and derivational operations
Christopher Hammerly

Background: It is commonly known that French has two grammatical gender classes: masculine and feminine. Crucially, every nominal in French is assigned gender, but the mechanism by which assignment occurs differs across nominal categories (Corbett, 1991). This leads to a distinction between semantically interpretable and uninterpretable sub-genders. The **interpretable** sub-gender (represented by upper-case "M" and "F") is assigned to nominals with a target referent that possesses a **salient and relevant biological sex property**. This sub-gender denotes the sex of the referent—masculine is assigned to nominals with a male referent and feminine to those with a female referent (example 1). The **uninterpretable** sub-gender (represented by lower-case "m" and "f") is assigned to nominals with a target referent that does not possess a salient or relevant biological sex property based on certain **phonomorphological properties** of the nominal's surface form. The uninterpretable sub-gender has no semantic import, and is assigned to all nominals denoting inanimate objects (example 2) and some denoting animate beings (example 3). The conceptual and phonomorphological assignment systems are in competition to be employed with any

given nominal in French.

(1) a. *l'étudiant (M/m)* "the (male) student"
   b. *l'étudiante (F/*f)* "the (female) student"
(2) a. **le table (*M/*m)* "the table"
   b. *la table (*F/f)* "the table"
(3) a. **le souris (*M/*m)* "the mouse"
   b. *la souris (*F/f)* "the mouse"

Puzzle: There are three concerns to fully account for the sub-gender alternations in French: (1) on what linguistic element is gender housed? (2) how can operations such as **Merge, Agree, Linearization, Spell-Out,** and **Encyclopedia Access** be integrated into a real-time derivational model of lexical production? and (3) how can the competition between the conceptual and phono- morphological assignment systems be reconciled in this model?

Proposal: Under the anti-Lexicalist assumptions of **Distributed Morphology**, both the masculine and feminine interpretable and uninterpretable gender features can be housed on the **functional nominal categorizing head *n*** (Kramer, 2013). These heads are paired with a **root**, which is an open-class index with purely differential value (Acquaviva, 2009). For gender assignment to occur, both the root and the semantically and grammatically correct gender-specified nominalizing head must enter the derivation via Merge. To do this, I create a lexical pro-duction model called the **Cascaded Interactive Derivation**. In this model, parallel activation from the **Encyclopedia**, the set of conceptual information associated with a nominalized root through Encyclopedia Access, and the **Vocabulary**, the set of phonological content inserted at terminal nodes via Spell-Out, are allowed to compete to activate and Merge the correct n-root pairing. When the biological sex of the referent is salient and relevant, conceptual activation from the Encyclopedia takes precedence and an interpretable sub-gender is Merged. Otherwise, phonological activation from the Vocabulary is stronger and an uninterpretable sub-gender enters the derivation. Once the proper elements are Merged, two other operations occur: (1) Agree, which leads to the valuation of gender on heads such as D or V; and (2) Linearization, which results the correct serial order of terminal nodes and morphemes.

Conclusion: The present proposal represents a radical departure from the traditional assumption of a modular linguistic derivation by replacing it with a parallel and interactive production model. I show that this model provides a neat way to account for the assignment of grammatical gender to French nominals, and is highly consistent with recent experimental evidence on the relationship between linguistic knowledge and conceptual representation (e.g. Bender, Beller, & Klauer, 2011).

Semantic Bias for Food and Body Information Among Women with Eating Disordered Traits

Maya Libben

Research has demonstrated a relationship between psycho-pathology and semantic activation within the mental lexicon. For example, Richards and French (1992) found that participants suffering from generalized anxiety disorder showed greater semantic priming effects for "threat related" word pairs (e.g., sharp – knife) than control participants. In the current study, we investigated the relationship between eating disordered traits and semantic bias in the mental lexicon. Eating disorders are characterized by a serious disturbance in eating behaviour and a preoccupation with food, body image, and weight. 116 non-clinical women (ages 18-24) performed a lexical decision task where critical targets (e.g., rolls) were preceded either by a food/body related prime (e.g., tummy – rolls) a non-food/body related prime (e.g., bakery – rolls) or an unrelated prime (e.g., window – rolls). Participants completed a series of eating disorder questionnaires including the Body Shape Questionnaire (BSQ; Cooper et al., 1986), the Eating Disorders Examination Ques-tionnaire (EDEQ; Fairburn & Belgin, 2008) and the Eating Attitudes Test (EAT; Garner et al., 1979). Participants showed significant priming for both food/body-related word pairs ($t(230)= 2.03$, $p<.05$) and non- food/body-related word pairs ($t(230) =2.43$, $p<.05$). The magnitude of the semantic priming effect in the food/body related condition and the non-food/body related condition did not differ ($t(230) = 0.94$, $p>.05$) Bias towards food/body related primes was established by calculating the difference between food/body related priming effects and matched non-food/body related priming effects for each participant. We found that larger difference scores (i.e. a stronger semantic bias towards food/body information) was positively correlated with scores on the BSQ ($r=0.36$, $p<.001$), the EDEQ ($r=0.25$, $p<.01$) and the EAT ($r=0.27$, $p<.01$). Therefore, the presence and severity of eating disordered traits was found to be positively associated with semantic bias towards food/body information. Clinical applications of the current task are discussed.

Synonymic Idioms in Mental Lexicon

Irina Borozdina, Tatiana Sazonova, Natalya Arzamastseva

This experimental research aims at finding out the peculiarities of the processing of synonymic phraseological units (idioms) in the mental lexicon of native speakers. The major question under investigation is whether there is any hierarchy in the mental representation of these language units, and how it influences their functioning in speech.

Lexical units with fully or partially transferred meaning have long been an object of psycholinguistic research [Schweigert 1986; Swinney & Cutler 1979] and thus, due to their complicated structure and transference of meaning, have been known as language items with a specific way of functioning in the mental lexicon. Therefore, our prediction is that synonymic idioms are not equally salient in the mind of a speaker and are processed in the mental lexicon in a hierarchical way. The criteria for salience of one idiom in the synonymic group are different from those relevant for free lexical items.

The language material used in the experiment is 6 groups of German idioms which have a similar meaning and are united by reference to one concept. The number of idioms in each group is from 4 to 10, for example, a group of synonymic idioms connected with the concept „LOVE" and having the meaning of „to be in love": *einen Narren an jmdm. gefressen haben, jmdm. zu tief in die Augen gesehen haben, sein Herz an jmdn. verloren haben, in jmdn. verknallt sein, jmdn. in sein Herz schließen, jmdn. im Herzen tragen, bis über beide Ohren verliebt sein.*

The participants of the experiment are 230 native German speakers, all citizens of the Federal Republic of Germany with the age range from 18 to 65. The stages of the research and the used methodology are as follows. To avoid subjectivity, after collecting a corpus of synonymic idioms from [Das Synonymwörterbuch 2006; Wörterbuch der deutschen Idiomatik 2008], we offer the randomly arranged lists of idioms to the respondents with the task to group together the items which have a similar meaning. These groups of idioms are offered to other respondents to be sorted out according to the criteria which

define the salience of one idiom among the rest. For example, the native speakers are asked such questions as: "Which of the idioms is mostly often used?", "Which idiom did you get to know first? How old were you then, and what were the circumstances?", "Are all the idioms equally known to you?" "Which idiom has a more general meaning?" and alike. Finally, the received information is analyzed statistically and the synonymic idioms are arranged in hierarchical models.

As the experimental data show among a group of synonymic idioms there is a unit which is represented in the mind as a subjective functional and semantic center with the rest idioms also having different salience. The choice of a certain idiom for the subjective center is determined by a number of factors depending on the individual's linguistic and extra-linguistic knowledge and experience. The reasons why one idiom is more prominent than the others are in some way different from the criteria which define a synonymic dominant in a synonymic set of free lexical items.

Word Retrieval Process Analyzed by Clustering & Switching Components in Phonemic & Categorical Verbal Fluency Test by Japanese L2 learners of English & Japanese- English Bilinguals
Keiko Asano

This study investigated how different Japanese second language learners of English and Japanese-English Bilinguals orally produce words from their native languages aspects of process of clustering and switching in Verbal Fluency Test. This task is commonly used in clinical and neuropsychological assessments for checking language development and frontal lobe function. As for the assessment for lexical capability, the Test was applied and conducted to Japanese second language speakers of English and Japanese-English bilinguals.

The Test is consisted on two different tasks: phonemic and categorical sections. As for phonemic verbal fluency test, the participants were to produce orally as many different words as possible beginning with the given letter such as "S" within a minute. In the categorical one, assigned item's names such as "animals" were asked to produce also within a minute. In this study, in order to examine the qualitative words production process more precisely, clustering (the production unit of words within phonemic or categorical sequence) and switching (the ability to shift efficiently to a new phonemic or categorical word), which Troyer and Moscovitch (1997) proposed were adopted to analyze as the important components of fluency performance. Especially in phonemic fluency, besides utilizing four phonemic characteristics of clustering (First letters, Rhymes, First and last sounds, and Homonyms) proposed by Troyer

(2000). The clustering and switching components in categorical fluency were also analyzed.

As the results for the phonemic clustering in native languages, both of Japanese L2 learners of English produced the words followed by their native phonemic characteristics. The number of times clustered was very small when produced in English, and the switching was frequently occurred. As for the number of times clustered, Japanese-English bilinguals produced larger when produced in English, and use different words retrieval process compared with Japanese L2 learners of English. Even in the clustering in Japanese as native language, both of groups retrieved the words followed by different clustering phonemic characteristics. Moreover, it was interestingly observed that some speakers were even used their categorical clustering during the production of phonemic performance. Overall, these two components are less correlated with the number of words generated on the phonemic fluency test. On the other hands, as for the categorical fluency in clustering and switching components, Japanese L2 learners of English depend on using phonemic strategies to retrieve these words rather than sub-categorical assigned names. The further studies will be focused on how the different brain area is activated when the words are clustered and switched to generate among the different speakers.

Animals but no mammals as a category in the mental lexicon
Deok-Hee Kim-Dufor, Philippe Tigreat, Claude Berrou

Thousands of living things, objects, and actions are named and classified by humans. Are all these categories present in the mental lexicon? Several neuroimaging studies have tried to show semantic representations in the brain, which covered quite vast categories or dimensions (Just et al. 2010, Huth et al. 2012). In written word recognition tasks, is it really helpful to

have prior category information?

We designed a paradigm in C++ allowing measuring the amount of information (pixels) necessary for written word recognition and verifying a possible category effect. Our paradigm had three sessions and each of them constituted a category of twenty 4- to 9-letter French words: living things, animals, and

mammals. Ten words were supplementarily chosen for a training test. Each word was pixelated; the pixels of each word displayed and the order of words were random in each round. The display rate at the beginning was 0.25%, then 0.5%, and increased following an increment of 0.5%. Twenty-three volunteers (14 M & 9 F; MA: 39 yrs 5 mos) participated in this experiment. All were native French speakers with normal or corrected-to-normal vision. The 1st group (11 persons) was not informed of the categories contrary to the 2nd group (12 persons). The participants were asked to tap the spacebar as soon as they recognized the words. It stopped the sequence, and the participants had to type the word they had just recognized. Tapping the spacebar after typing the word rekindled the sequence.

No significant difference was found between two groups in terms of the number of correct answers. A strong category effect in display rate (F=4.712, P=0.0091) and a group effect in reaction time (F=3.90, P=0.0484) were observed. The category effect we found corroborates the findings in Huth and colleagues' study specifying that the semantic dimension animal vs. non animal is important to organize the concepts in the brain whereas the dimension mammal vs. non mammal does not exist. This category effect with no difference between groups would result from what could be called "preceding word priming". In other words, even the group that was not informed of the category was somewhat helped by the preceding word recognized. The group effect in reaction time suggests that knowing category information seems to help participants respond more quickly. It could be argued that long interstimulus interval (2850ms in our study) with the given category as expectancy facilitated the response resulting in shorter reaction time (Harley, 2008).

Further studies with more categories will be necessary to verify other dimensions in the mental lexicon. Multimodal stimuli might provide more accurate responses.

Platform Session 2.2

11.00—11.20

Mass and Count Noun Processing in Alzheimer Disease

Sara Mondini, Gonia Jarema, Giorgio Arcara

11.20—11.40

Exploring Individual Differences in Irregular Word Recognition Among Children with Early-Emerging and Late-Emerging Word Reading Difficulty

Laura Steacy, Donald Compton, Devin Kearns

11.40—12:00

Spelling rehabilitation using transcranial direct current (tDCS) in primary progressive aphasia (PPA)

Kyrana Tsapkini, Constantine Frangakis, Argye Hillis

Mass and Count Noun Processing in Alzheimer Disease
Sara Mondini, Gonia Jarema, Giorgio Arcara

Nouns may refer to entities that can be counted (e.g., two bottles) and entities that can be measured (e.g., much rice). In linguistics and philosophy, these two different types of nouns have been labeled as mass and count nouns. Mass and count nouns feature distinct semantic and syntactic properties (Gillon, 1992) and one main issue in psycholinguistics is concerned with the role of syntax and semantics in their processing. Stein- hauer, Pancheva, Newman, Gennari, and Ullman (2001) claimed that the difference between mass and count nouns relies mostly on syntax. However, other studies suggested that in online processing of mass and count nouns, the role of semantics might be fundamental as well (Chiarelli et al., 2011). Some inconsistencies in the literature may be traced back to the differences between tasks investigating semantic or syntactic processing (e.g., Taler

& Jarema, 2004).

In the present study, we tried to overcome previous limitations by addressing the role of semantics and syntax in mass-count processing with two similar tasks. One task involved mainly semantic processing, whereas the other involved mainly syntactic processing. The performance of a group of 26 Italian participants with Alzheimer disease (AD) was investigated in a semantic judgment task and a syntactic judgment task. People with AD are known to exhibit primarily a semantic deficit, rather than a syntactic one. We thus exploited this characteristic of AD to address the role of semantics in mass and count noun processing and to determine whether it is more relevant for one category of nouns than for the other. A balanced set of stimuli was selected, taking into account several psycholinguistic variables (length, frequency, familiarity, age of acquisition and imageability). Results were analyzed by means of mixed-effect models, revealing an interaction between task and stimulus category: the probability for correct responses to mass stimuli was significantly lower than for count stimuli, but only in the semantic task. These findings suggest that semantics, too, may play a prominent role in the processing of mass and count nouns, and that the role of semantics or syntax may be task dependent. Results also indicate that mass nouns have specific features that make them more prone to impairment than count nouns for a progressively degenerating brain.

Exploring Individual Differences in Irregular Word Recognition Among Children with Early-Emerging and Late-Emerging Word Reading Difficulty

Laura Steacy, Donald Compton, Devin Kearns

Automaticity of word recognition, a process that is minimally influenced by background knowledge or context-based expectancies (see Stanovich, 1991), provides fluent and reliable retrieval of word spellings from the orthographic lexicon activating pronunciation, syntax, morphology, and semantic information to be used by the reader to form faithful representations of texts (Perfetti, Landi, & Oakhill, 2005). As children learn to read, the orthographic lexicon expands through an increase in the absolute number of orthographically addressable entries, referred to as "word-specific" representations (Ehri, 2014). Word-specific representations are considered to be less dependent on phonological processes because these representations have been supplanted by specific connections linking spelling directly to pronunciations (Perfetti, 1992; Share, 1995).

Developing readers add word-specific entries to the orthographic lexicon, to a large extent, by employing a phonological recoding self-teaching mechanism (Share & Stanovich, 1995). Studies have reported that relatively few successful decoding exposures to a word are required for the acquisition of word-specific representations in typically developing readers (Reitsma, 1983). This implies that word-specific representations form relatively rapidly as children develop reading skills and likely depend on individual differences in the frequency and richness of text reading (Cunningham & Stanovich, 1998). Compared with typically developing readers, children with reading difficulties (RD) require a greater number of successful exposures to a given word to establish a stable and reliable word-specific representation (Ehri & Saltmarsh, 1995). Early difficulty in the acquisition of word-specific representations in children with RD has been linked to deficits in phonological processing skills (Brady & Schankweiler, 1991).

However, the addition of word-specific representations to the orthographic lexicon is likely modulated by factors beyond phonological processing skill, particularly for words with irregular spelling-to-sound relationships. Models of irregular word recognition that take into account both child- and word-level predictors have not been developed in typically developing and children with reading difficulty (RD). The purpose of the present study was to model individual differences in irregular word recognition ability among 5th grade children (N = 173), oversampled for children with RD, using item-response crossed random-effects models. We distinguish between two subtypes of RD children with word recognition difficulties, those with early-emerging RD and late-emerging RD. Initial models indicate that individual differences in item-level irregular word recognition are predicted by multiple predictors at the child-level (RD status, vocabulary skill, phonemic awareness, and orthographic coding skill) and word-level (word frequency and spelling to pronunciation transparency rating). Final models will include interactions between child- and word-level predictors. Results will be interpreted within a multisource individual difference model of irregular word recognition spanning child-level, and word-level, and child- by word-level interactions.

Spelling rehabilitation using transcranial direct current (tDCS) in primary progressive aphasia (PPA)

Kyrana Tsapkini, Constantine Frangakis, Argye Hillis

Introduction: Spelling impairments are one of the first deficits that occur early in PPA and can usually predict the variant of PPA in which the patient may progress (Sepelyak et al., 2011). PPA is a neurodegenerative disease that affects people relatively early in life (between 55-65 years) and therefore it is important to find ways to alleviate the symptoms or impede the degree of degeneration. We present and discuss new data indicating that a neuromodulatory treatment, using transcranial direct current stimulation (tDCS) combined with a spelling intervention, shows promise for maintaining or even improving language abilities in PPA. The aim of this research is to determine whether tDCS plus language therapy is more effective than language therapy alone in treating written language deficits in PPA.

Methods: Eight PPA participants underwent anodal tDCS or sham plus spelling intervention in a randomized order using a within-subject cross-over design. They were evaluated before, after, and at 2 weeks and 2 months post-intervention. Spelling intervention varied for each participant according to the main

spelling deficit: 3 patients had phoneme-to-grapheme conversion (PGC) intervention, 2 had lexical intervention and 3 had advanced PGC intervention (combined with written fluency and PGC practice). Four more patients have already finished the first period of stimulations (ether sham or tDCS) and all their other sessions and evaluations will be completed in the next couple months.

Analyses-Results: We analyzed the existing set of full data using both within-subject analyses (McNemar tests) and across-subjects analyses while taking into account carry-over effects. We evaluated therapy effects by the Generalized Estimating Equation approach (Liang & Zeger, 1986). All participants showed improvement in spelling after spelling intervention in trained items (with either sham or tDCS). There was, however, a significant improvement for untrained items only in the tDCS plus language therapy condition compared to sham at all follow-up intervals but mostly at 2 months post-intervention.

Conclusions: We discuss these results with emphasis to the particular challenges of this method. Neuromodulation with tDCS offers promise as a means of augmenting language therapy to improve written language function, at least short-term, in PPA. The consistent finding of generalization of treatment benefits to untreated items and the superior sustainability of treatment effects with tDCS justifies further investigations. Possible explanations of brain mechanisms involved and current efforts in investigating them are also discussed.

Platform Session 2.3

13.00—13.20

Causality in Cascaded Language Change: How Morphology Drives Syntax

Fermin Moscoso del Prado Martín

13.20—13.40

Efficient phonological clustering in the mental lexicon

Kyle Mahowald, Isabelle Dautriche, Edward Gibson, Anne Christophe, Steven T. Piantadosi

13.40—14:00

Toddlers use distributional properties to "predict the unpredictable"

Helen Buckler

Causality in Cascaded Language Change: How Morphology Drives Syntax
Fermin Moscoso del Prado Martín

Considering language as a complex dynamical system is a promising new avenue in Linguistics (e.g., Hawkins & Gell Mann, 1995, Beckner et al., 2009). This approach enables the study of language at the macroscopic scale (Mandelbrot, 1957), which can unearth relationships that are difficult or impossible to understand at the level of individual constructions. Throughout their history, languages are hypothesized to alternate between periods of drift and metastable states (e.g., Dediu et al., 2013). Metastable states are periods during which a language undergoes little change. When a disturbance changes the properties of one part of the language (e.g., the morphology, the lexicon, the syntax, …), the change might push the system away from the metastable state. This is thought to cause a cascade of other changes across the grammar. Linguists have often postulated such chains of changes in the history of languages (e.g., Sapir, 1921; Lightfoot, 2002). However, it remains to be explicitly shown –beyond apparent sequentiality– that changes at one level of the grammar *cause* changes at other levels. Here, I introduce an approach for studying linguistic change at the macroscopic scale.

I hypothesize that periods at which change is happening at a language's grammar would be detected in a higher diversity of grammatical forms at use, reflecting how the older forms coexist with the newer ones. For morphology, this diversity can be measured using the average *inflectional entropy* (Moscoso del Prado et al., 2004) of the words in the language. For syntax, one can measure the grammatical entropy (Grenander, 1976; Hale, 2006) of the probabilistic context-free grammar that describe the language.

Using a large diachronic parsed corpus of Icelandic covering the time period between the XII and the XX century (Wallenberg et al., 2011), I demonstrate that changes in the morphological paradigms of the language cause (in the strict Granger sense; Granger, 1967) changes in the syntax of the language, and importantly, not the other way around (i.e., changes in syntax temporally follow changes in morphology in a statistically reli-

able way).

These results demonstrate how changes in the lexicon push the system away from equilibrium, leading to a necessary reorganization of other parts of a language. It provides, for the first time, direct statistical evidence for causality in cascaded linguistic change, and for the 'punctuated equilibrium' nature of languages (Dixon, 1997; Atkinson et al., 2008).

Efficient phonological clustering in the mental lexicon

Kyle Mahowald, Isabelle Dautriche, Edward Gibson, Anne Christophe, Steven T. Piantadosi

Recent evidence suggests that cognitive pressures associated with language acquisition and use could affect the organization of the lexicon. On one hand, consistent with noisy channel models of language (e.g., Levy 2008), the phonological distance between wordforms should be maximized to avoid perceptual confusability (a pressure for *sparsity*). On the other hand, a lexicon with high phonetic regularity would be simpler to learn, remember and produce (e.g., Monaghan et al., 2011) (a pressure for *clumpiness*). Here we investigate wordform similarity in the lexicon, using measures of word distance (e.g., *phonological neighborhood density*) to ask whether there is evidence for sparsity or clumpiness of wordforms in the lexicon. We develop a novel method to compare observed lexica to phonotactically-controlled baselines that provide a null hypothesis for how clumpy or sparse wordforms would be as the result of only phonotactics. Beyond this phonotactic baseline, we present evidence for widespread clumpiness, using a highly-controlled comparison of four languages, as well as a broader analysis of 115 languages.

1) **Simulating null lexica**: We first studied monomorphemes in Dutch, English, German (CELEX) and French (Lexique). To control for phonotactics, we built several generative models of lexica: ngrams over phones, ngrams over syllables, and a PCFG over syllables. After training, we evaluated each model on a held-out dataset to determine which generative process most accurately captured each language. We then used the best model to generate simulated "null" lexica for which there is no pressure for sparsity or clumpiness, beyond phonotactics. Comparison of the wordform distance in real languages (a test statistic) to lexica generated from the best phonotactic model (providing a null distribution of the test statistic) allows us to determine if the real lexicon is significantly sparser or clumpier than would be expected by its phonotactics alone. Across a number of measures of lexical clustering (e.g. neighborhood size, string edit distance, clustering coefficients, etc.) we found that the real lexicon had a tendency to be clumpier than the best null lexicon for most measures. For instance, in all languages the average edit distance between two words in the real lexicon was smaller than the edit distance in the simulated one (all ps < .05). Note that this is not the result of morphological regularities since only monomorphemes were used.

2) **Cross-linguistic frequency**: A second analysis shows that a pressure for clumpiness can also be found in the frequency patterns of word use (see Frauenfelder et al. 1993). If the lexicon is influenced by a pressure for clumpiness, we should expect that higher-frequency words exhibit stronger patterns since they are used more often and thus subject to more communicative or cognitive optimization. Using orthographic lexicons from 115 languages extracted from Wikipedia (top 20,000 most frequent wordforms in each language and treating each length separately), we found that almost all languages (111/115), show significant (p <.05) positive Spearman correlations between log-frequency and the number of neighbors (mean r = .18). This effect is, in part, driven by a correlation in 112/115 languages for more orthographically probable words (as measured by an ngram model over letters) to be more frequent (mean r = .22). Thus, frequent wordforms tend to be phonotactically likely and have more neighbors—suggesting a pressure for clumpiness that becomes stronger with use.

3) **Semantic clumping**: For each pair of words in English and in French, we computed the pair's semantic similarity using LSA on Wikipedia and matched it to a pair of words from the simulated lexicon. Pairs with smaller edit distance are more likely to be semantically similar than phonologically distinct words (ps<.001) at a rate above chance (ps<.05). The trend for semantically similar words to be phonologically similar is evidence for lexical clustering.

Conclusion: Across a variety of measures, we showed that lexicons have the tendency to be clumpier than expected by chance. This reveals a fundamental drive for regularity in the lexicon that conflicts with the pressure for words to be as phonetically distinct as possible.

Toddlers use distributional properties to "predict the unpredictable"

Helen Buckler

Non-allophonic morphophonological alternations, such as the voicing alternation in Dutch, are notoriously difficult to acquire. In production studies school-aged children persistently fail to produce voicing alternations accurately (Kerkhoff & De Bree, 2005). Previous accounts assume that the difficult arises because the alternation is unpredictable and can only be learned on an item-by-item basis. The learner must encounter multiple forms from a morphological paradigm, have the cognitive skills to be able to posit links between them and notice the alternation (Peperkamp & Dupoux, 2002). Ernestus and Baayen (2003), however, showed that the presence or absence of an alternation in a morphological paradigm in Dutch is predictable if the phonological composition of the stem is considered. Adults make use of this predictability when inflecting novel words. We conducted a corpus study of child-directed speech (CDS) to establish whether voicing alternations are also predictable in the toddler's input and conducted two experiments to investigate whether Dutch 3-year-olds incorporate this likelihood informa-

tion in their lexical representations of voicing alternations.

Dutch has a voicing contrast word-initially and word-medially, but the contrast is neutralised word-finally. In this position only voiceless obstruents are permitted. Neutralisation gives rise to voicing alternations within morphological a paradigm. The word *bed*, for example, is pronounced with a stem-final [t] in the singular [bɛt], but [d] in the plural [bɛdəən]. In other paradigms voiceless segments are retained in all forms, e.g. one [pɛt], two [pɛtəən] ("cap(s)"). A corpus-study of singular-plural pairs in CDS revealed that the phonological composition of the stem provides information about the likelihood of intra-paradigmatic voicing alternations. If a stem-final obstruent is preceded by a vowel there is a 37% likelihood that the obstruent alternates. If the preceding segment is a sonorant an alternation occurs in 75% of cases. We hypothesised that toddlers use this distributional information to aid them in specifying whether a paradigm contains an alternation or not. Children and infants are known to be sensitive to distributional properties of words in other domains of speech perception and acquisition (e.g.

Mattys & Jusczyk, 2001; Storkel, 2001).

In a plural elicitation task Dutch 3-year-olds' production accuracy of familiar words with a stem- final [t] in post-vocalic and post-sonorant contexts was measured. Despite making frequent devoicing errors in alternating paradigms, accuracy was significantly modified by context (post- vocalic [d] = 23.4%, post-sonorant [d] 38.6%). The same toddlers also participated in a Preferential Looking task and were presented with mispronunciations of voicing in familiar plural words (e.g. *betten* or *pedden*). Again, phonological context was manipulated. In both post-vocalic and post-sonorant conditions toddlers were sensitive to mispronunciations of /t/. They were sensitive to mispronunciations of /d/ post-sonorantally, but not post-vocalically. Both indicate the impact of phonological context on lexical representations of voicing alternations.

Results provide insight into the structure of the developing mental lexicon. Non-allophonic alternations are difficult to acquire, but not impossible. Alternations do not occur at random, and toddlers, like adults, make use of distributional statistics.

Poster Session 2.2

14.00—15.00

1. Priming of Transparent Derived Verbs in L2 Speakers: An fMRI Study
Sophie De Grauwe, Kristin Lemhöfer, Roel M. Willems, Herbert Schriefers

2. Are all thematic relations created equal? ERP investigation of Agent-Patient, Agent-Property, and Agent-Location relations in semantic memory
Olessia Jouravlev, Ken McRae

3. Relationships between first and second language vocabulary knowledge across linguistically distinct languages
Alexandra Gottardo, Amna Mirza, Aline Ferreira

4. Stress processing in Greek compounds. Evidence from aphasia
Athanasios Tsiamas, Gonia Jarema, Eva Kehayia, Dimitrios Kasselimis, Constantinos Potagas, Ioannis Evdokimidis

5. A Child Language Acquisition in the First Stage: The Correlation of the three Partitive Models of Language Production Apparatus with Linguistic unit
Mohamed Hadji

6. The Comprehension of Pronunciation Variants by Second Language Learners
Sascha Coridun, Mirjam Ernestus, Louis ten Bosch

7. The price of knowledge: bilingual paired associate learning
Ching Chu Sun, Peter Hendrix, Harald Baayen, Michael Ramscar

8. L2 proficiency and language experience in early morphological processing
Armina Catargiu, Pirita Pyykkönen-Klauck, Juhani Järvikivi

9. The effects of proficiency and age of acquisition on brain activation and white matter connectivity in Mandarin-English bilinguals
Emily Nichols, Marc Joanisse

10. An LSA-based Method for Estimating Words' Location and Breadth in Semantic Space
Russell Richie, Stefan Kaufmann, Whitney Tabor

11. The timing of morphological decomposition: Evidence from inflected words
Ehsan Shafiee Zargar, Naoko Witzel

12. Morphosyntax in the Mental Lexicon Causes Processing Difficulty for Late Bilinguals
Helena Trompelt, Sina Bosch, Harald Clahsen

13. Tracking the effects of signal degradation on lexical access
Anita Wagner, Deniz Baskent

14. Rehabilitation of Primary Progressive Aphasia by transcranial Direct Current Stimulation: a case study
Barbara Penolazzi, Maria Merigo, Giovanna Chiarion, Sara Mondini

15. Perceptual significance of the correlation between morphology and vowel duration found in spontaneous speech production
Michelle Sims, Benjamin V. Tucker

16. Searching for Feature Weights
Danny Moates, Z. S. Bond, Verna Stockmal

17. Dichotic listening with specific, general, abstract

and emotional words — semantic judgments and reaction times

Frida Mårtensson, Mikael Roll, Magnus Lindgren, Jonas Brännström, Merle Horne

18. When nonnative words compete and when they don't...

Svetlana V. Cook, Kira Gor

19. The Influence of Orthographic Experience on the Development of Functional Phonological Unit in Spoken Word Production

Chuchu Li, Min Wang

20. Does Lexical Retrieval Practice Reduce Tip-of-the-Tongue (TOT) Experiences in Aging?

Amy Vogel, Shannon Doody, Jungmoon Hyun, Loraine Obler

21. Lexicality Judgments in Healthy Aging and in Alzheimer's disease (AD): A Behavioral Psycholinguistic and Electrophysiological Investigation

Nancy Azevedo, Eva Kehayia, Ruth Ann Atchley, Vasavan N.P. Nair

22. Lexical access to monoargumental, biargumental and triargumental verbs: A cross-language and cross-population behavioral study

Marie Pourquié

23. Learning vocabulary and grammatical gender: A study with novice Swedish and English L2 learners of German Julia Hotchner Advior: Dr. Carrie Jackson

Julia Hotchner

24. The Relationship between Saudi EFL Learners Strategies of Organizing the Mental Lexicon and the Quality of Listening and Reading Comprehension "An Experimental Study"

Faizah Alhammadi

25. The Paradigmatic Lexicon: Morphological processing in a complex verbal system

Joyce McDonough

26. Separating Segmental and Tonal Information in Visual Word Recognition with Second Language Learners of Chinese

Joshua Davis, Min Wang

Priming of Transparent Derived Verbs in L2 Speakers: An fMRI Study
Sophie De Grauwe, Kristin Lemhöfer, Roel M. Willems, Herbert Schriefers

Native (L1) speakers have been found to decompose semantically transparent derived words (whose meaning can be deduced from the meanings of their parts, e.g. *wegleggen* 'put aside') in many behavioral and some fMRI studies. The brain region usually implicated in morphological decomposition is the left inferior frontal gyrus (LIFG): In a previous fMRI long-lag priming study, this region was found to be deactivated upon presentation of the primed word of a morphologically related word pair. In non-native (L2) speakers, the processing of transparent derived words has hardly been investigated, especially in fMRI studies, and results are contradictory: Some behavioral studies have found more reliance on holistic processing by L2 speakers, some have found no difference between L1 and L2 speakers.

In this fMRI long-lag priming study, we investigated the processing of Dutch semantically transparent, morphologically complex derived verbs to find out whether they are decomposed or processed holistically by L2 speakers and a control group of L1 speakers. Half of the derived verbs were preceded by their stem with a lag of 4 to 6 words ('Primed'); the other half were not ('Unprimed'). Eighteen Dutch L1 speakers and 21 German L2 speakers of Dutch made lexical decisions on these visually presented verbs.

A ROI analysis over both groups showed that there was significant deactivation for Primed compared to Unprimed derived verbs in the LIFG. Even though the interaction between Priming and Language Group was not significant, a closer look at the data showed that this effect was large and statistically significant for the L2 group alone, but not for L1 speakers alone (although they did show the same pattern descriptively). The results of the ROI analyses were confirmed in a whole-brain analysis. Thus, L2 speakers show a clear priming effect in the LIFG, whereas the evidence for a priming effect in L1 speakers is less clear.

As mentioned before, the LIFG has been associated with morphological decomposition. Our finding of LIFG deactivation in L2 speakers is consistent with the idea that L2 speakers decompose morphologically complex verbs rather than processing them holistically. Results will be discussed in the context of the available behavioral and neuroimaging data on the processing of morphologically complex words in L1 and L2 speakers.

Are all thematic relations created equal? ERP investigation of Agent-Patient, Agent- Property, and Agent-Location relations in semantic memory
Olessia Jouravlev, Ken McRae

Concepts co-activated due to the fact that they are constituent parts of certain themes, events, or scenarios are known as being thematically related. The questions of representation of thematically related concepts in memory have been raised by a number of researchers (Borghi & Caramelli, 2003; Lin & Murphy, 2001). However, as McRae, Khalkhali, and Hare (2012) note, one of the drawbacks of many prior studies in the field of semantic memory is that the great diversity of semantic relations is treated as if these relations are homogeneous. However, the heterogeneity of thematic relations (cf. *bird – cage; bird –*

spring; bird – beak; bird - seed) is quite obvious. However, it has attracted only limited attention in semantic memory research. Some researchers have enumerated various thematic relations that may occur between items (Estes, Golonka, & Jones, 2011; Borghi & Caramelli, 2003). Spatial (e.g., *milk – jar*), temporal (e.g., *turkey – Thanksgiving*), causal (e.g., *fire – warmth*), possessive (e.g., *mailman – bag*), and productive (e.g., *bee – honey*) relations are among the most often mentioned ones. However, these distinct relations are still often treated as essentially identical.

In the present study, we tested whether there are distinctions in three types of thematic relations (Agent-Property, Agent-Patient, and Agent-Location) that influence the way that people process them. Agent-Property relations are established between a concept and one of its constituent parts and/or functional relations (e.g., bird – beak; builder - hammer). Agent-Patient relations are established between a concept which performs the actions of the verb and a concept which receives the actions of the verb and changes its state (e.g., bird - seed). Finally, Agent-Location relations describe locations of actions, events, or situations (e.g. bird – cage).

In this study, we assessed behavioral (decision latencies) and electrophysiological (ERPs) responses evoked by participants engaged in a relatedness judgment task, in which participants were presented with a concept (cue) followed by another related or unrelated concept (target). Three types of related targets and unrelated targets were matched on length, imageability, word frequency, AofA, strength of cue-target association, and local and global cue-target co- occurrence. Three types of related targets were also matched on relatedness judgment ratings collected in a pilot study.

Decision latencies and ERPs time-locked to the presentation of the target concept were collected and analyzed. In the analysis of behavioral data, decision latencies were shorter for thematically-related (M = 824 ms, SD = 120 ms) than for unrelated pairs of concepts (M = 867 ms, SD = 139 ms), t(22) = 4.57, p < .001. Further, participants were much faster in identifying Agent-Property (M = 818 ms, SD = 120) than Agent-Patient (M = 843 ms, SD = 125) relations, t(22) = 2.42, p = .02. Responses to Agent-Location relations (M = 811 ms, SD = 117) were also faster than to Agent-Patient relations, t(22) = 2.71, p = .01. There was no significant difference in the decision latencies for Agent-Property vs. Agent-Location relations, t(22) = 0.43, p = .67. The ERP results for the three types of thematic relationships (which are currently being analyzed) appear to replicate the pattern observed in the analysis of the behavioral data and will be discussed along the behavioral findings. The preliminary conclusion based on the behavioral findings is that there are, in fact, some processing differences for three types of thematic relations. In establishing different types of thematic connections between concepts, people are likely to utilize somewhat different cognitive mechanisms. These results imply that there is indeed some heterogeneity in semantic relations and that researchers in the field of semantic memory should take this heterogeneity into consideration.

Relationships between first and second language vocabulary knowledge across linguistically distinct languages

Alexandra Gottardo, Amna Mirza, Aline Ferreira

Some researchers view language acquisition as being related to global, language general variables such as language aptitude (Sparks, Patton Ganschow & Humbach, 2011) or to first language proficiency (Cummins, 1991). However, the majority of research on vocabulary development has been on the transfer of cognate knowledge (Dijkstra, Grainger & van Heuven, 1999; Nagy, Garcia, Durgunoglu & Hancin-Bhatt, 1993). The Urdu language is widely spoken in Pakistan; the family tree of Urdu is: Indo-European to Indo-Iranian to Indo-Aryan to Urdu (Masica, 1993). Urdu has borrowed its script from Arabic and Farsi and shared its morphological, syntactic and phonological structure with Hindi (national language of India). Urdu vocabualry has been mixed with the vocabulary of Arabic, Farsi and the native languages of South Asia. It also contains borrowed words from English and shares approximately one fourth of its vocabulary with English. However, Urdu and English entirely differ in their script, as well as some of their phonology, making semantic comparisons interesting.

Cummins (1991) suggests that bilingual children with learning problems in their first language (L1) will also manifest similar difficulties in their second language (L2) (and vice versa). Therefore, children with deficient language and cognitive skills will experience problems regardless of the language. For instance, English skills should be better for bilingual children with a high Urdu vocabulary and they should not experience difficulty in acquiring their L1. Therefore, the current study examined the cross-linguistic relations on vocabulary for children whose home language is Urdu but who are skilled speakers of English.

For the present study, fifty Canadian bilingual Urdu-English speaking children (6-10 years) were tested for language ability, cognitive and phonological processing skills in two languages: Urdu their L1 and English their L2. Expressive vocabulary was measured in English using the Expressive One Word Picture Vocabulary Test and an Urdu version of this measure.

Children were classified as low on Urdu if they had low scores, less than 4, on the measure of Urdu vocabulary. This score was calculating by subtracting the shared English-Urdu vocabulary items from the total words correct. Children were classified as having adequate Urdu vocabulary if they had scores above 10 on the Urdu vocabulary items. Binary logistic regression showed that English vocabulary differentiates children who were classified based on whether they had low or adequate scores on the Urdu vocabulary items. Phonological processing was another variable that was related to group classification. These findings suggest that the ability to learn vocabulary across languages is not solely related to cognates, but is also related to general linguistic skills related to vocabulary.

Stress processing in Greek compounds. Evidence from aphasia

Athanasios Tsiamas, Gonia Jarema, Eva Kehayia, Dimitrios Kasselimis, Constantinos Potagas, Ioannis Evdokimidis

Stress plays an important role in the Greek language because it operates as a contrastive feature (e.g., nómos 'law' vs. nomós 'prefecture') and is lexically specified (e.g., Ralli 2007). Of particular interest are the stress properties of compounds where we observe two distinct main stress patterns: a) compounds preserve the stress position of the head word—the right-most constituent (no stress change, or NSC) or b) they invariably receive stress on the antepenultimate syllable (stress change, or SC).

Although phonological errors are well documented in aphasic speech, the majority of studies focus on segmental and not suprasegmental phenomena. In this study, we investigated the effects of stress change in compound processing, by exploring the performance of individuals with fluent and non-fluent aphasia using an auditory-auditory lexical decision task. We report the results from three Greek-speaking males, two (MD and AK) with Broca's and one (ED) with conduction aphasia. They were matched with control participants for age, gender and years of education. Experimental stimuli comprised a) 10 masculine and 10 feminine Noun-Noun compounds for each category (NSC and SC), each matched with its second constituent as a prime

and an unrelated control word, b) 45 pairs of filler words and c) 100 pairs of non-words. We hypothesized that if prosodic mechanisms are impaired in aphasia, performance will differ from that of controls with respect to stress processing in compound words.

Overall, aphasic performance was not uniform. While priming was observed for most comparisons across SC and NSC compounds, ED exhibited inhibition for masculine SC compounds, and was faster responding to control-primed stimuli than to experimental ones. Gender appeared to induce differential performance across the three participants with aphasia with similar, but attenuated effects observed also in the controls. Performance on SC compounds was differential across aphasic and control participants, reflecting both cost effects of processing stress change and potential participant specific etiology.

Overall, findings provide evidence for the importance of exploring specific features and processes involved in language processing as a means of obtaining a better understanding of aphasic performance.

A Child Language Acquisition in the First Stage: The Correlation of the three Partitive Models of Language Production Apparatus with Linguistic unit

Mohamed Hadji

A large number of researches were increasingly investigated for the issue of how children come to generate language. Therefore, major linguists agreed and attributed the Language Production Apparatus (LPA) which is mainly consisted of three partitive models Conceptualization, Formulation, and the Articulation (CFA) during the process of the language production. On the basis of this view, the problem statement of the present research is: "What is the correlation between the three partitive models and the linguistic unit-Sign by Ferdinand De Saussure during the first stage of a child?". Furthermore, the goal of this research is to provide a description of relationship between LPA and its components and with linguistic unit-sign. The Study

is also descriptive in its nature and it depends upon the case study approach. In addition, a simple distributional analysis of recorded Corpus (Bloom, 1970, p.10) from which the eight common summarized list of two-word utterance and their semantic relation expressed in a table (cf.Brown, p193-197) were excerpted and used as collected data for the purpose of conducting this research. In conclusion, the study showed that there was a relationship between the linguistic unit-sign and Language Production Apparatus' Components in Child Language Production during the first stage. The findings pointed out further that the child language structure is based upon CFA and linguistic unit-sign or (Signified/Signifier) of child's worldview.

The Comprehension of Pronunciation Variants by Second Language Learners

Sascha Coridun, Mirjam Ernestus, Louis ten Bosch

In casual speech, word segments are often very short or even absent. For example, in casual French, schwa is frequently absent in word initial syllables, such as in the word *pelouse* 'lawn' which can be pronounced in its full [pəluz] or in a reduced variant [pluz]. Several studies found a general processing cost for the reduced variants (e.g., Racine and Grosjean, 2005). Importantly, the difficulties associated with reduced variants are amplified for non-native listeners. A possible explanation is that second language learners lack lexical representations for reduced variants, as they learnt the language in the classroom, where they are mostly presented with full forms and with orthography, which corresponds to the full forms.

We conducted two experiments with low-proficient Dutch learners of French, in order to investigate the role of their exposure to reduced variants and the role of spelling on the recognition of these reduced variants. Both experiments included a learning phase followed by an auditory lexical decision task. In the learning phase, participants were auditorily presented with either the full or the reduced variants of French schwa words that were novel to them (e.g., [pəluz] or [pluz]). In Experiment 2, participants were additionally presented with the corresponding word spellings (e.g., *pelouse*). The lexical decision task was identical for the two experiments and consisted of two conditions: the trained words were presented to participants in

either the same variant as in the learning phase (match condition) or in the other variant (mismatch condition).

In Experiment 1, both full and reduced variants were recognized faster and more accurately in the match condition than in the mismatch condition. Crucially, participants' overall performance was similar for the full and the reduced variants. This suggests that reduced variants are not inherently more difficult to recognize. In contrast, in Experiment 2, in which learners had also learnt the spellings, their overall performance was better for the full forms. They recognized the full forms well even if they had learnt the reduced variants. This difference to Experiment 1 demonstrates that spelling facilitates recognition of full variants.

In conclusion, these results suggest that learners indeed have problems understanding reduced variants because of a lack of exposure, which may result in weak or non-existent lexical representations for these forms. Moreover, focus on spelling may lead to strengthening of lexical representations for full variants. We conclude that acoustic input and orthography together determine the strength of phonological representations in the mental lexicon.

The price of knowledge: bilingual paired associate learning
Ching Chu Sun, Peter Hendrix, Harald Baayen, Michael Ramscar

In the paired associate learning task, participants are asked to memorize pairs of words, for instance north-south or jury-eagle. In the recall phase, the first word of a pair is presented (e.g.; "north", "jury") and participants are asked to produce the second word (e.g.; "south", "eagle"). Typically, an age effect is observed in paired associate learning, with older participants performing less well than younger participants. This age effect is much more prominent for harder word pairs such as "jury"-"eagle" than it is for easier word pairs such as "north"-"south" (see Ramscar et al. (2014)).

Two hypotheses exist regarding the age effect in paired associate learning. The first postulates that older participants suffer from cognitive decline. Under this hypothesis, the decreased performance of old participants in paired associate learning is a consequence of a general decrease in cognitive abilities as we get older. Alternatively, however, the changes in performance over the lifespan might be the result of increased linguistic experience. Under this hypothesis older people may perform less well for items such as "jury"-"eagle" due to a lifetime of learning that "jury" is an uninformative cue for "eagle".

To tease apart both hypotheses, we carried out a bilingual paired associate learning study. Four groups of participants were used in the experiment: young German monolinguals, old German monolinguals, young Chinese-German bilinguals and old Chinese-German bilinguals. The German speakers performed the paired associate learning task in German only, whereas the Chinese-German bilinguals performed the task in both German and Chinese.

Two interesting findings emerged from the experiment. First, we replicated the age effect that is typically observed in monolingual paired associate learning. For both monolingual Germans and Chinese-German bilinguals in Chinese we observed an age effect, with young participants performing better than old participants. For Chinese-German bilinguals in German, however, no such age effect was present in the data. While this finding poses a challenge to the cognitive decline hypothesis, it follows straightforwardly once we take linguistic experience into account: unlike in their first language, older people are not hindered by a lifetime of learning about cue informativity in their second language.

The second interesting finding is that participants performed better in their second language than in their first language. In both age groups, Chinese-German bilinguals performed better in German than in Chinese. Furthermore, Chinese-German bilinguals performed better in German than did German monolinguals. This demonstrates once more that linguistic experience is of key importance to understanding the patterns of results in paired associate learning. Participants perform better in their second language than in their first language, because their knowledge about the co-occurrence patterns of words is more limited.

Taken together, the current findings for bilingual paired associate learning demonstrate that – rather than being a symptom of cognitive decline - the decreased performance of neurologically healthy older monolinguals in the paired associate learning task is a simple consequence of increased exposure to the language. When the exposure to a language is controlled for, old participants perform no worse than do young participants. In monolingual paired associate learning, older participants therefore pay the price of knowledge. In a variety of other tasks, however, it is exactly this knowledge that allows older participants to outperform younger participants (see Ramscar et al., 2013).

L2 proficiency and language experience in early morphological processing
Armina Catargiu, Pirita Pyykkönen-Klauck, Juhani Järvikivi

Since Rastle et al. (2004), research has shown that both pseudo-derived ('brother') and real derived words ('brothy') equally facilitate their [pseudo]stem ('broth') in forward masked priming. This has been taken as evidence for an automatic morpho-orthographically based segmentation phase that handles both real and apparent word- internal structure the same way at the early stage of visual word recognition in first language (L1) processing. One of the current debates is whether second language (L2) learners' processing of complex words is similar to native word recognition with some recent answers to the affirmative (e.g., Diependaele et al., 2011). Importantly, little is known of whether and how the degree of L2 proficiency modulates this process.

In this study we asked how 36 Norwegian L2 learners of Eng-

lish process English real derived ('caller'), pseudo-derived ('corner') and non-derived ('turnip') words and whether their level of proficiency in English (as measured by grammar and vocabulary tests) and the extent of English usage (self-assessed) would predict their word recognition performance. In the masked priming experiment, 34 target words such as BROTH were primed by real words in 4 Conditions: Transparent (brothy), Opaque (brother), Form (brothel), and Control (member).

Multilevel linear analyses of RTs for the manipulated predictors revealed significant effect of prime type that showed significant facilitation in the Transparent Condition only (p=0.050). We then proceeded to assess the effect of various item and participant-based factors. The self-assessed amount of time spent using written English (whether writing or reading) relative to spoken English usage (speaking or listening) significantly predicted word recognition speed (p=0.039). Importantly, we found

two significant interactions: First, the grammar test score interacted with the priming condition, showing significantly faster RTs for the opaque ('brother') words (p=0.042), but not for the other conditions. In addition, the (COCA-based) frequency relation between the prime and the target affected the processing of these opaque words: We found a significant effect of the prime/target log frequency ratio on reaction time latencies, suggesting that the more frequent the opaque prime was compared to its target, the slower the responses were (p=0.003). Similar effects were not found in other conditions.

The results suggest that 1) (lack of) semantic transparency does affect the processing of pseudo-derived words already in the early phase; and 2) the extent to which second language is used in the visual modality affects L2 word recognition overall. More importantly, whether your brother helps with your broth, depends on how proficient you are in English.

The effects of proficiency and age of acquisition on brain activation and white matter connectivity in Mandarin-English bilinguals
Emily Nichols, Marc Joanisse

It has been established that both proficiency and age of acquisition (AoA) affect second language (L2) processing (Perani et al., 2003; Warternburger et al., 2003). However, few studies have investigated how these two factors jointly influence the brain organization of first and second language processing. The present study aimed to address this by investigating the semi-independent effects of L2 proficiency and AoA on both functional activation and white-matter structural differences in Mandarin-English bilinguals. Twenty-three bilinguals of varying L2 AoAs and proficiency levels completed a picture-word matching task in both English and Mandarin while undergoing BOLD-weighted MRI, followed by a diffusion tensor imaging (DTI) scan. Proficiency levels and AoA were assessed by means of a detailed proficiency test and a questionnaire. By using multiple regression, it was possible to treat these variables as continuous, rather than dividing subjects into groups of high/low proficiency and early/late AoA. Likewise, although the two measures were partly correlated, multiple regression allowed us to tease apart the independent effects of either on the fMRI and DTI measures. Analyses of fMRI data showed that AoA and proficiency independently modulated brain activity during L2 word recognition. Specifically, while AoA predicted activation

levels in the left superior temporal gyrus and right parahippocampal gyrus, proficiency was correlated with activity in areas including right insula, right middle temporal gyrus, and left parahippocampal gyrus. DTI analyses revealed congruent effects; we used functionally-defined regions of interest as seeds for probabilistic tractography, then calculated mean fractional anisotropy (FA) and mean diffusivity (MD) values for each set of tracts. Analyses revealed that AoA independently predicted FA in white matter tracts emerging from the left middle temporal gyrus and the right supramarginal gyrus, as well as MD in the white matter tracts emerging from the left parahippocampal gyrus and right insula. Proficiency was correlated with FA in white matter tracts emerging from the right supramarginal gyrus, and was not correlated with MD. These results suggest that proficiency and AoA explain separate networks of both functional and structural organization in the bilingual brain, suggesting separate types of plasticity influence age-dependent effects (i.e., AoA) from those of experience and/or predisposition (i.e., proficiency) in second language learning. We conclude by discussing ways to disentangle the direction of the relationship between behavioural measures and structural differences.

An LSA-based Method for Estimating Words' Location and Breadth in Semantic Space
Russell Richie, Stefan Kaufmann, Whitney Tabor

Accounts of phenomena including lexical access, semantic change, and Zipf's Law all invoke word meaning location and breadth in semantic space. For example, Manin (2008) claims that Zipf's Law arises because (1) word meanings broaden/narrow diachronically to avoid excessive synonymy (overlap in semantic space), yielding a 'Zipfian Covering' of the space, and (2) word frequencies correlate with word meaning breadth. However, investigations of such accounts have been limited; no existing method localizes words to regions of space, rather than points (typical of current corpus cooccurrence techniques). Here we describe such a method, and test Manin's hypothesis.

Our method generally falls into the family of Latent Semantic Analysis approaches. We first count word-word co-occurrences in a corpus, yielding vectors representing each word type's meaning. We then pass through the corpus again, and for each token of each word type, sum the type vectors of the other words in the token's context to yield a vectorial representation of that token's meaning. Each word type is thus represented by a cloud of tokens in semantic space. Finally, for each type, we compute the convex hull around the token cloud. The volume of the hull measures semantic breadth; the facets of the hull localize it to a region of semantic space.

We applied our method to 1000 tokens for each of the 1000 most frequent content words in the British National Corpus. Corroborating Manin's second claim, we find that word volumes rank-correlate with word frequency (ρ = .19, p < 10-9). We then evaluate Manin's first premise, which predicts that volumes also follow a power law distribution. Evidence for this was ambiguous: volumes fit a power-law distribution with a cut-off at the 239th most voluminous word type (Kolmogorov-Smirnov D = .039, p = .16), but a power-law distribution with a cut-off was no more or less likely than a log-normal distribution (loglikelihood ratio = -.29, p = .77) or an exponential distribution (loglikelihood ratio = .95, p = .33). This comes as a surprise, as power-laws in the distribution of number of dictionary definitions per word or degree distribution of semantic networks, have been previously claimed, but, crucially, not rigorously tested.

Our method thus uniquely provides a way to localize words to regions, rather than simply points, of semantic space. The positive correlation between word frequency and word volume and the tentative plausibility of a power-law distribution of volumes provide some first evidence of plausibility of Manin's account of Zipf's Law. We are now working to exploit the novel contribution of our method to evaluate Manin's claims of Zipfian covering of semantic space. We are also developing psycholinguistic applications of our method, including an account of priming and lexical neighborhood phenomena that depend on volume overlap/proximity.

The timing of morphological decomposition: Evidence from inflected words

Ehsan Shafiee Zargar, Naoko Witzel

This study investigates the timing of morphological decomposition of inflected words during visual word recognition. Past literature has revealed that morphological decomposition of morphologically-complex words occurs relatively early, even before accessing the meanings of these words (Rastle et al., 2004). A question still remains as to how early this decomposition occurs – i.e., whether it co-occurs with letter position assignment (see e.g., Duñabeitia et al., 2007) or it takes place only after this stage (see e.g., Rueckl & Rimzhim, 2011). Note that many of these studies have tested either derivationally-complex words or compound words, both of which are formed by relatively unproductive processes, and thus may have whole word representations (Taft & Ardasinski, 2006). The current study tests inflectionally-complex words, whose formation is more rule-governed and generally predictable by grammatical requirements. We hypothesized that morphological decomposition of inflected words is more crucial than derived words or compound words, and thus, decomposition of such inflected words might occur earlier during the visual word recognition process. In order to test this, two masked transposed-letter (TL) priming experiments were conducted. TL primes based on suffixed words with four types of inflectional morphemes (-*ing*, -*ed*, -*er*, or -*est*) were created by transposing two adjacent letters either within the root morpheme (*fcousing*) or across the two morphemes (*focuisng*). Experiment 1 used the inflected words (*FOCUSING*) as targets, while Experiment 2 used the root forms (*FOCUS*). Response times for each of these conditions were compared to their orthographic controls. Following previous studies, we predicted that if morphological decomposition co-occurs with letter position assignment, then TL priming will be observed only in within-morpheme condition, and not in across-boundary condition. This is because transposing letters across morphemes obscures the morpheme boundary. If, on the other hand, morphological decomposition occurs after letter assignment, then TL priming will be obtained in both conditions. Interestingly, the results from both experiments showed similar TL priming effects for within-morpheme and across-boundary positions. This suggests that morphological decomposition occurs only after letter positions have been assigned, even in affixed words with rule-based morphology. These findings will be discussed in terms of distinct stages during visual word recognition.

Morphosyntax in the Mental Lexicon Causes Processing Difficulty for Late Bilinguals

Helena Trompelt, Sina Bosch, Harald Clahsen

While sentence-level morphosyntactic processes (e.g. subject-verb agreement) have been shown to cause difficulty in a late-learned non-native (L2) language (White, 2003; Clahsen et al., 2010), lexical aspects of language appear to be easier to handle in an L2. In many languages, however, morphosyntactic information is not only encoded at the sentence level, but also lexically, e.g. through stem variants representing different morphosyntactic feature sets. The German verb *werfen* ('to throw'), for example, has six stem allomorphs (*werf, wirf, warf, worf, würf, wurf*) which encode morphosyntactic information such as tense, person, and number. However, there is relatively little research on how morphosyntactic information is represented in the L2 mental lexicon.

To address this gap, we examined morphosyntactic feature processing by comparing priming effects between marked and unmarked stem forms of German verbs in native (L1) speakers of German and high-proficiency L2 learners with Russian as L1. A cross-modal immediate repetition priming experiment examined asymmetries between these forms (*wirft-werfen* vs. *werfen-wirft*) relative to identity controls (*werfen-werfen*, *wirft-wirft*). We measured the size by which the different morphosyntactic feature sets in the test conditions reduced the repetition-priming effect of the corresponding control conditions. If comprehenders are sensitive to morphosyntactic information, we expect asymmetric priming effects. In a prime-target pair such as *wirft-werfen*, for example, the unmarked stem *werf-* presented as part of the target word does not contain any unprimed features when primed by *wirf-*, whereas in the reverse case (*wer-*

fen- wirft) the marked stem *wirf-* contains morphosyntactic features that are unavailable from the prime werf-; consequently, we expect less reduction of repetition priming for the former than for the latter.

Twenty-six L1 (mean age: 22,8) and 26 L2 speakers of German (mean age: 24,5; AoA: 11,7; Goethe Placement Test score 26.4/30, 'C1'-level) participated in the study. An additional offline task asked participants to produce the verb forms tested in the main experiment. Twenty-three late bilinguals with Russian as L1 (mean age: 24,9; AoA: 12,1; Goethe score: 27, 'C1') were compared to a group of 23 German L1 speakers (mean age: 29,1). Seven L2 participants took both experiments, with a time lag of six to eight months between the two.

In the offline production task, both participant groups scored close to ceiling (>95% correct) for both marked and unmarked stem forms. Repetition priming effects were also parallel for L1 and L2 participants, with shorter target response times for [*werfen-werfen*] than for [*wirft-wirft*]. Between-group priming differences, however, were found for the morphosyntactic conditions. In the L1 group, primes with marked stems (e.g. *wirft*) facilitated the recognition of the target form with the corresponding unmarked stem (e.g. *werfen*) significantly more than vice versa. This was not the case for the L2 group; instead, unmarked stems proved to be more efficient primes in the L2.

Although the late bilinguals were highly proficient in German, the results of the priming experiment suggest that stem allomorphy is represented differently in an L1 and an L2, with late bilinguals relying less on morphosyntactic information than native speakers.

Tracking the effects of signal degradation on lexical access

Anita Wagner, Deniz Baskent

How does the degraded speech signal find its way into the mental lexicon? The acoustic signal of speech is attributed a double sided role in most models of speech perception. One the one hand the signal contains acoustic variation that needs to be normalized before it can be matched to mental representations. On the other hand a lot of systematic variation in fine phonetic detail facilitates word recognition, for instance by resolving lexical embedding and constraining lexical competition between words like *ham* and *hamster* (Salverda, Dahan and McQueen, 2003). This paper investigates the time course of resolution of lexical embedding for speech stimuli that have been degraded in order to simulate signals transmitted via cochlear implants. This degradation systematically reduces the spectral details but preserves durational cues that are crucial for the resolution of lexical embedding (Salverda et al., 2003; Davis, Marslen-Wilson and Gaskell, 2002).

In two eye-tracking experiments, we adapted a design similar to Salverda et al. (2003) to study whether durational cues can govern lexical competition also for spectrally degraded speech. Reliance on durational cues was studied by recording listeners' gaze fixations to four pictures simultaneously displayed, showing a multisyllabic target (e.g., painting) and an onset-matching lexical competitor (e.g., pain), along with two unrelated distractors. Listeners were presented with sentences in which the target contained durational cues that were either coherent with the target or with the competitor. The stimuli in Experiment 1 were natural recordings, and in Experiment 2 vocoded versions of these recordings were used.

Our results show that listeners' gaze fixations are governed by the durational cues only for natural stimuli. Spectral degradation reduces the reliance on durational cues, even though durational information is intact in the spectrally impoverished vocoded stimuli.

These findings contribute to the discussion of how much acoustic detail is necessary in the speech signal for lexical mechanisms to effectively self-regulate the process of word recognition. Further, these results also pose questions about the level of abstraction in models of speech perception.

Rehabilitation of Primary Progressive Aphasia by transcranial Direct Current Stimulation: a case study

Barbara Penolazzi, Maria Merigo, Giovanna Chiarion, Sara Mondini

Many studies have shown the efficacy of transcranial Direct Current Stimulation (tDCS) in improving language functions in post-stroke aphasia (for a review see Mally, 2013). However, data on its therapeutic value in treating linguistic deficits in neurodegenerative disorders, like Primary Progressive Aphasia (PPA), are still insufficient, though promising (Cotelli et al., 2014, Wang et al, 2013). In this study we aimed at further investigating the tDCS efficacy in slowing down the linguistic decline in a patient with non-fluent PPA (male, 60 years, high level of education). The patient underwent a first cycle of treatment, consisting of four phases in which active stimulation periods (10 sessions, of 20 min each, distributed in 2 weeks) were alternated with periods of treatment cessation (i.e. phase 1: anodal stimulation of the left dorsolateral prefrontal cortex, lDLPFC; phase 2: no stimulation; phase 3: anodal stimulation of Wenicke's area; phase 4: no stimulation). Qualitative analyses of performance in a picture naming task administered after each phase showed that stimulation of the lDLPFC was more effective than stimulation of Wenicke's area. Therefore, in a following cycle of treatment only the lDLPFC was stimulated. The design of this second cycle was analogue to the first, but, this time, we compared the efficacy of tDCS at rest with that of tDCS during linguistic processing (i.e. repetition and reading). Namely, in this second treatment cycle four phases were alternated: phase 1: anodal stimulation of the lDLPFC at rest; phase 2: no stimulation; phase 3: anodal stimulation of the lDLPFC during linguistic processing; phase 4: no stimulation. Qualitative analyses of performance showed that the picture naming task was facilitated by stimulation at rest (i.e., phase 1), whereas the phonemic fluency task was facilitated by stimulation during linguistic processing (i.e. phase

3). This pattern may suggest that stimulation during linguistic processing is more effective than stimulation at rest depending on the overlapping between the processes used during stimulation and the processes used to assess tDCS efficacy. The most remarkable result of this study, however, was found in the general linguistic abilities measured by Aachen Aphasie Test (AAT).

The AAT administered four times, at equal intervals within one year, revealed that, despite a progressive worsening of the general linguistic profile, the decline was notably reduced during neuromudulation. These additional data highlight the potential role of tDCS in slowing down the linguistic decline in Primary Progressive Aphasia.

Perceptual significance of the correlation between morphology and vowel duration found in spontaneous speech production
Michelle Sims, Benjamin V. Tucker

In the present study, we investigate the relationship between morphology and the perception of fine acoustic detail (vowel duration) in spontaneous speech. It is often assumed that correlations between linguistic predictors and phonetic detail in production occur because the relationship subsequently aids perception (Aylett & Turk, 2004). The present study investigates how such correlations affect the subsequent perception of irregular English verbs. Tucker (2013) reported that vowels with a higher degree of past/present tense morphological predictability in irregular English verbs - such as /i/ which is highly predictive of the present tense as in *see* - are produced with longer durations than those vowels with a lesser degree of morphological predictability - such as less predictive /ɛ/ which occurs in both the present tense *get* and past tense *met*. To test for perceptual significance, we performed a lexical decision task on duration-manipulated stimuli. Given the correlation between morphology and vowel duration found in production (more morphologically predictive vowels are produced with *longer* durations than less predictive vowels), we expect that switching the correlation (i.e. more predictive vowels are produced with *shorter* durations than less predicted vowels) will result in slower reaction times within a lexical decision task.

The stimuli for our lexical decision experiment were recorded by a male speaker of western Canadian English. The speaker produced 216 word/nonword items (36 of which were irregular English verb target items) in the carrier sentence "She clearly said today" at five different rates of speech set by a metronome. For each item of interest in the mid-speech rate carrier sentence (i.e. the word/nonword in the blank), we replaced the original vowel with a vowel from either a faster or slower rate of speech recording (according to the Tucker (2013) production model), resulting in longer or shorter vowel productions. By splicing in a vowel from a different recording of the same sentence, the phonetic environment was kept intact and we were able to ensure that the only manipulation is the duration of the vowel of interest. Native speakers of western Canadian English participated in the lexical decision experiment, yielding response accuracies and response latencies to the items.

Results from an early stage of data collection indicate that when verbs are presented with the opposite vowel duration than expected (i.e. when reversing the correlation between morphology and vowel duration), reaction times become slower. This is true for vowels in words representing both a low and high levels of morphological predictability. We take this to mean that altering the production-based correlation between vowel duration and morphology results in an increase in recognition difficulty. We believe this supports Aylett and Turk's (2004) notion of the interdependence of production and perception and supports a listener-oriented approach to the mental lexicon where representations of produced forms are stored with information about their subsequent perception.

Searching for Feature Weights
Danny Moates, Z. S. Bond, Verna Stockmal

Many models of lexical retrieval assume that phonetic segments are composed of distinctive features, e.g., McClelland & Elman (1986) and Stevens (2005). The more feature information in the acoustic signal matches the features of a phonetic segment, the better the chances of identifying the segment. Moates, et al. (2013) tested this hypothesis in a task which involved retrieving lexical items from similar-sounding nonwords. Their experiment largely supported the hypothesis. Similar effects have been reported by Bölte (1997) and Connine et al. (1993).

How can we conceptualize the "weight" of a feature? In the simplest conception, all features contribute equally to specifying a segment; in a more complex relationship, features do not contribute equally and the relative weights of different features must be established empirically.

To explore this approach, we used words differing in one segment to estimate the contribution of different features, that is, to estimate feature weights.

Sixty nonwords were created by combining pairs of real words, e.g., the words grated and plated can be combined into the nonword glated. All word pairs were two-syllable words with the consonants to be changed occurring in the stressed syllable. The word pairs were controlled for word frequency, length, uniqueness point, and number of neighbors. 57 of the changes were located at word onset and 59 were located word internally. The words were presented to 38 native speakers of English. Participants heard each nonword spoken twice, followed by the segment to be changed, and wrote down the word.

Error scores were calculated for each item as an indicator of difficulty in overcoming feature mismatch. That is, to recover the word grated from the non-word glated involves overcoming the feature [lateral].

The average error rate for one-feature differences ranged from a low of .17 for [coronal] to a high of .54 for [nasal], a difference just short of statistical significance. Variability was quite

high and samples were too small for this strategy to be effective.

To establish a baseline for evaluating individual features, we computed error rates for two clearly defined features, point of articulation for stops and nasals. These produced an error rate of .27 with SD =.27, too high to serve as a baseline

A third strategy was to rank order error rates for one-feature differences to observe the relative standing in weights of individual features. We found that the order of rankings was inconsistent across two different samples.

We conclude that these three strategies require further testing. A satisfactory test will require a set of materials that permit large numbers of one-feature differences, each having a satisfactory sample of instances.

Dichotic listening with specific, general, abstract and emotional words — semantic judgments and reaction times
Frida Mårtensson, Mikael Roll, Magnus Lindgren, Jonas Brännström, Merle Horne

In a dichotic listening test, different auditory stimuli are simultaneously presented to the right and left ear. Linguistic stimuli have been found to be processed faster and more accurately when presented in the right ear. A possible explanation for this right ear advantage (REA) is that the right ear has a more direct neural pathway to the left, language dominant hemisphere (Kimura 1967). In contrast, the left ear/right hemisphere is more specialized for other types of auditory information, e.g. melodies (Kimura 1967) and emotional prosody (Ley & Bryden 1982).

Whereas CV syllables with different consonants have been extensively used in dichotic listening studies (e.g. Hugdahl 2000), studies taking semantics into account are fewer, with some notable exceptions (e.g. Ely et al. 1989). The present study investigated whether words with different semantic content differed in their degree of lateralization. Thirty right-handed native Swedish speakers listened to dichotically presented words and nonwords and reaction times were measured as they made abstract/concrete semantic judgments. Four semantic categories differing in their concreteness and emotional arousal were compared: specific (e.g. 'banana'), general (e.g. 'fruit'), abstract (e.g. 'idea') and emotional (e.g. 'joy'). Following Ely et al. (1989), it was hypothesized that emotional arousal as well as high concreteness would activate the right hemisphere to a larger degree, resulting in a less pronounced right ear advantage (REA) for specific and emotional words. Furthermore, general words were expected to activate imagery in the right hemisphere to a lesser degree than specific words, leading to a relatively greater REA.

In the semantic judgment task, specific and general words were consistently categorized as concrete, whereas abstract and emotional words were categorized as abstract. Reaction time analysis showed that although most participants had a REA for test-words, there was also a subgroup with the opposite pattern, a left ear advantage (LEA). Within-subjects ANOVAs revealed that in the REA group, there were main effects of ear as well as wordtype, with words from the abstract category taking significantly longer time to process compared to specific and general words. The LEA group showed a main effect of ear only. No ear x wordtype interactions were found. These results are discussed in relation to structural and attentional models of dichotic listening (Hiscock & Kinsbourne 2011).

When nonnative words compete and when they don't…
Svetlana V. Cook, Kira Gor

A greater number of activated words typically leads to increased competition at the selection stage, resulting in delayed lexical access (Hamburger & Slowiaczek, 1996). In a second language (L2), spurious phonological effects may lead to an increased number of competitors, which in turn, increases the time needed to select the lexical target (Broersma & Cutler, 2008, 2011).

The present study tests two alternative hypotheses, both of which predict the outcomes opposite to the ones reported by Broersma and Cutler (2008, 2011), namely, facilitation for phonological neighbors in L2 auditory lexical access. The first hypothesis argues in favor of the qualitative representational deficit in L2. According to this hypothesis, competition leading to increased latencies takes place only when L2 representations are robust. Weak L2 representations cannot produce strong inhibition in the words, which would normally strongly compete for selection in L1 (Gollan et al., 2005; Diependaele, Lemhöfer, & Brysbaert, 2013).

The alternative hypothesis, which also predicts reduced lexical competition in L2, has to do with the mere size of non-native lexicon (e.g., Nation, 2006). In a smaller lexicon, there are fewer competitors available due to an overall limited number of lexical items represented; accordingly, the hypothesis argues in favor of a quantitative difference between L2 and L1 mental lexicons.

The study addresses these two competing hypotheses about the source of reduced competition that leads to reduced latencies in L2 by controlling the two critical factors—the size of competitor sets in L2 lexicons based on L2 proficiency, on the one hand, and the quality of lexical representations as measured by a translation task with familiarity ratings, on the other. It compares lexical access in three groups of participants, two groups of L2 learners of Russian— Intermediate and Advanced, and a group of Russian native speakers (NSs), and reports the results of two behavioral experiments: an auditory Lexical Decision Task (LDT) and an auditory Lexical Decision Task with Phonological Priming (Primed LDT). In the LDT, Advanced learners showed sensitivity to the number of cohort neighbors, or the size of the competitor set, comparable to NSs. Words from small competitor sets resulted in reduced latencies compared to words from large competitor sets. Intermediate learners, conversely, showed no effect of the competitor set size. In the Primed LDT— a task aiming at identifying the degree of the pre-lexical facilitation during lexical access—the Advanced group showed weak

facilitation in the large cohort and strong inhibition in the small cohort conditions. The Intermediate group followed a similar pattern, with even stronger facilitation in the large cohort, but weaker inhibition in the small cohort condition. The results confirmed the prediction that reduced competition in L2 lexical access does not stem from the limited number of competing words. In addition, a reanalysis of the data with a variable that accounts for participants' individual familiarity with the words used as experimental stimuli provided additional evidence in favor of the representational—or qualitative—explanation for reduced competition effects.

Overall, the study demonstrated that the lack of fine phonological detail in lexical representations allows for prelexical processing to have a greater effect on the success and speed of access. More specifically, if for L1 speakers the contribution of lexical competition dominates over prelexical activation, for L2 speakers it is the prelexical processing that has the greatest effect, especially during lexical access of less known words.

The Influence of Orthographic Experience on the Development of Functional Phonological Unit in Spoken Word Production
Chuchu Li, Min Wang

The functional phonological unit refers to the first selectable phonological unit under the word level, and its function is to constrain phonological retrieval and encoding and finally guide the planning of the articulation (Kureta, et al., 2006; O'Seaghdha, et al., 2010). Previous literature suggested that the functional phonological unit is syllable segment (i.e., atonal syllable) in Mandarin among literate adults (O'Seaghdha, et al., 2010; Chen & Chen, 2013). The current project investigated the development of functional phonological unit among native Mandarin- speaking children and the influence of orthographic experience.

Using a form preparation paradigm, Chen and Chen (2013) asked native Mandarin-speaking adults to name a series of pictures, the names of which may share the same onset, same initial syllable segment or nothing systematically in common (control condition). Compared with the control condition, participants only showed faster naming latency in the same initial syllable segment condition but not the same onset condition, suggesting that they only benefited from fore-knowledge of same initial syllable segment. Therefore, it is claimed that the functional phonological unit is syllable segment in Mandarin adults, and this unit is consistent with the orthographic form of Chinese character-a morphosyllabic writing system in which one character represents one syllable. However, using a similar paradigm and ERP methodology, Qu and colleagues (2012) suggested that phoneme onset might be the fundamental unit in phonological retrieval and encoding. Qu et al. suggested that this onset effect may be related to participants' experience in Pinyin, an alphabetic writing system in Chinese. Actually, a number of studies have shown that Pinyin experience among native Mandarin

speakers improves their sensitivity to small units such as phoneme onset (Read, et al., 1986; Shu, et al., 2008).

In Mainland China, children study an alphabetic writing system Pinyin at the beginning of Grade 1, and begin to study morphosyllabic Chinese characters afterwards. The aim of the current study is to investigate whether the change from extensive Pinyin exposure in Grade 1 to extensive Chinese character exposure in Grade 4 and adults may lead to the change in functional phonological unit. Three groups of participants will be recruited, including 1) Grade 1 children at 7 years of age, 2) Grade 4 children at 10 years of age, and 3) adult participants. A picture naming task with the form preparation paradigm was employed based on Chen and Chen (2013) with modifications. The names of a list of pictures may share the same onset or same syllable. If participants show an onset facilitation (i.e., significant faster naming latency in the same onset condition than the control condition), it suggests that onset serves as the functional phonological unit. Six participants in each age group were recruited in the pilot study, and only Grade 1 children showed clear onset facilitation.

Preliminary results suggested that onset might be the functional phonological unit in Grade 1 children but not in Grade 4 children and adults, largely due to the different orthographic experiences. The findings of the current study improves our understanding of the influence of orthographic experience on language processing, and it can also guide teachers and educators to develop more effective pedagogical approaches to facilitate children's development of phonological processing skill by integrating children's phonological training with their orthographic experience.

Does Lexical Retrieval Practice Reduce Tip-of-the-Tongue (TOT) Experiences in Aging?
Amy Vogel, Shannon Doody, Jungmoon Hyun, Loraine Obler

Research indicates that lexical retrieval becomes increasingly difficult with advancing age (Evrard, 2002; Goral et al., 2007; Kavé et al., 2010). One widely supported account of lexical retrieval decline known as the Transmission Deficit Hypothesis (TDH) suggests that weakened lexical-to-phonological connections lead to the unsuccessful or incomplete retrieval of the phonological form of the word (Shafto et al., 2007; Burke et al., 1991; Burke & Shafto, 2004). This phenomenon, when the semantic and grammatical content of a word can be retrieved but only partial phonological information can be accessed, is re-

ferred to as a TOT state.

In the field of healthy aging, there is a dearth of research examining the variables that may offset linguistic decline. To our knowledge, only one study to date has examined experience-related factors, beyond education that may account for preservation of word-naming in older individuals, and the researchers found that better naming was linked to active linguistic processing as compared to passive forms of language use (i.e., reading vs. TV watching) (Barresi et al., 1999). Recently, directed language activities, such as lexical retrieval practice, have been

found to enhance and improve language abilities That is, word-retrieval practice has been shown to facilitate future retrieval of the trained target items such that response latencies are reduced and accuracy is improved (Burke & MacKay, 1997). In view of the TDH, repetitive naming encourages the strengthening of neural connections by activating them more frequently.

The purpose of the present pilot study was to examine the influence of constrained naming practice on the facilitation of lexical retrieval as evidenced by a reduction in TOTs and verbal fluency performance. The study included healthy older adults aged between 58 - 67 years (N = 6, M = 61.33) who were randomly assigned to participate in lexical retrieval training (N = 3, M = 60.66, SD = 2.08) or no training (N = 3, M = 62.00, SD = 4.58). The experiment lasted six weeks, in which time during pre- and post-testing all participants were administered verbal fluency tasks and a naming-to-definition task based on the TOT-inducing set of definitions (James & Burke, 2000). The training consisted of a rigorous online, naming-to-definition task that took place in participants' homes during the four weeks between testing sessions (5x/week for 15 min per session). A preliminary analysis of the data suggests that individuals in the experimental group showed a reduction in TOTs (Pretest: M = 33.69%; Post-test: M = 16.89%) compared to a matched group that did not receive training (Pretest: M = 44.8%, Post-test: M = 46.83%). This result suggests that lexical retrieval training may contribute to TOT reduction in healthy older adults. Also, all participants completed a language-oriented lifestyle questionnaire that determined participants' level of linguistic engagement in day-to-day living. Individuals, regardless of group membership, who reported spending more time playing word games also had significantly higher phonemic fluency scores (r = .865, p = .02). The results can be interpreted with respect to the TDH, in that word-naming practice may strengthen age-related weakening in connections between semantic and phonological nodes. As well, we will discuss how lifestyle factors among our group of healthy older adults impact verbal fluency abilities and TOT rates.

Lexicality Judgments in Healthy Aging and in Alzheimer's disease (AD): A Behavioral Psycholinguistic and Electrophysiological Investigation

Nancy Azevedo, Eva Kehayia, Ruth Ann Atchley, Vasavan N.P. Nair

The pattern of lexicality judgments changes with aging. When compared to young adults, older adults are slower when performing lexical decision tasks. However, this slowing appears to help improve accuracy, especially for pseudowords (Ratcliff et al., 2004). The presence of AD alters performance by further slowing response times and causing lower accuracy rates in lexical decision (Taler & Phillips, 2008). Previous results suggest that individuals with AD may have a specific propensity to over-accept pseudowords while correctly accepting words (Snyder et al., 1996). We present two experiments that probe processing lexicality in healthy older adults and in individuals with AD, using on-line behavioural psycholinguistic methodology (**exp 1**) and electrophysiological/ event-related potential (ERP) methods (**exp 2**).

Experiment 1: The on-line visual lexical decision task was performed in one session and comprised of 320 trials (80 experimental words (i.e. nouns); 80 filler words (i.e. verbs); 80 pseudowords; and 80 nonwords). Word stimuli were controlled for frequency, length, and number of syllables while pseudowords and nonwords were controlled for length and number of syllables. Participants were 18 English-speaking individuals with probable AD (11F, 7M), age (57-82), MMSE (16-29/30), education (7-21 years) and 24 healthy older adults (17 F, 7 M) with similar age and education. Results show that the two groups displayed a similar pattern of performance across the 3 stimulus types. There was no difference in error rates between groups for words: Z= -0.0137, p = 0.9891; pseudowords: Z= 1.0512, p = 0.2932; or nonwords: Z=1.4096, p = 0.1587. However, individuals with AD were significantly slower (significant main effect of Group (F(2, 78) = 8.95; p = 0.0003). Planned post-hoc tests showed that those with AD were significantly slower for words (p= 0.0057) pseudowords (p> 0.0001) and nonwords (p=0.0005). To complement behavioural data and obtain a better understanding of the processes underlying lexicality judgments, we used ERP tasks.

Experiment 2: Four blocks of the oddball lexical decision task, each consisting of targets (20% of trials) and distractors from distinct lexical categories. The oddball task is known to elicit the P3 ERP component for the target event trials and we use P3 amplitude as a means of determining the degree to which individuals can make use of lexicality as a salient feature this task. Four comparisons were examined: word targets among nonwords (W-Nw); word targets among pseudowords (W-Ps); nonword targets among words (Nw-W); and pseudoword targets among words (Ps-W). Participants were 7 English-speaking individuals with probable AD (3F, 4M), age (70-83), MMSE (16-29/30), education (15-21 years) and 17 healthy older adults (11 F, 6 M) with similar age and education. In contrast to exp 1, preliminary analysis shows that two groups did not exhibit a similar pattern of performance. For the older adults we observed a reliable P3 component at the Pz electrode for all tasks except W-Ps, while, individuals with AD did not show a reliable P3 for the W-Ps or Ps-W tasks and the P3 for the W-Nw and Nw-W tasks was greatly attenuated.

Results not only confirm the utility of the oddball lexical decision ERP task, but also highlight the importance of utilizing ERP methods along with behavioural as a means of obtaining a better understanding of processes underlying lexical decision.

Lexical access to monoargumental, biargumental and triargumental verbs: A cross- language and cross-population behavioral study

Marie Pourquié

This study addresses whether argument structure complexity defined as the number of arguments associated with verbs (intransitive / monoargumental, transitive / biargumental, ditransitive / triargumental) complexify or facilitate verb lexical access. Two contrasting views on this issue are found in the aphasiological literature. First, according to Thompson (2003), the richer the lexical verb entry — that is, the higher the number of arguments associated with it — the *harder* its lexical retrieval in agrammatic aphasia (i.e. non fluent aphasia characterized by impaired morphosyntax and putatively well preserved lexical processing). Second, according to Demoury and Balmès (2005), the richer the lexical verb entry, the *easier* the lexical retrieval of verbs in aphasia in general, due to the fact that the semantic network increases with the number of arguments and, therefore, makes complex lexical verb entries more salient and easier to retrieve.

These hypotheses lead to different behavioral predictions for patients. Depending on the theory, ditransitive verbs like "to give" would take, respectively, more or less time to be produced compared to either intransitive verbs like "to fall" or transitive verbs like "to eat". These predictions offer a good starting point to assess argument structure influence on verb lexical access: Is it advantageous or disadvantageous? Is its effect similar across languages and across populations (e.g. adults with aphasia, children with Specific Language Impairment, neurotypical adults and children, monolinguals and bilinguals)?

We designed a cross-linguistic test in Basque, French and Spanish which includes 30 lexical verbs for each language (10 intransitive, 10 transitive and 10 ditransitive). In order to determine whether argument structure complexity inhibits or facilitates verb lexical retrieval in both word and sentence contexts, the same verbs were used in action naming and sentence production tasks. Preliminary data collected from *French monolingual* neurotypical adults (N=10) and children (N=10); *Spanish monolingual* neurotypical adults (N=10) and children (N=10); *Basque/French and Basque/Spanish bilingual* neurotypical adults (N=10; 10) and children (N=10; 10), as well as one French patient with agrammatic aphasia will be presented.

This behavioral research aims to shed insight on the representation of verbs with different argument structures and to complement neuroimaging data regarding the neurocognitive mechanisms of verb argument structure processing (Thompson, Bonakdarpour & Fix, 2010).

Learning vocabulary and grammatical gender: A study with novice Swedish and English L2 learners of German

Julia Hotchner

Studies have shown that at least among highly proficient L2 speakers, the presence of grammatical gender in one's first language (L1) facilitates the acquisition of grammatical gender in a second language (L2) (Sabourin et al., 2006). Research also shows a processing advantage for cognates over noncognates in a variety lexical-level tasks among L2 learners (see van Hell & Tanner, 2012, for a review), and that this advantage can even extend to the online processing of L2 grammatical gender (Perotti et al., 2013). In the present study we build on these earlier findings to investigate whether cognate status and the presence/absence of grammatical gender in the L1 influence the acquisition of words and their grammatical gender among novice L2 learners.

In the present study, L1 Swedish and L1 English speakers with no prior knowledge of German were trained and subsequently tested on their knowledge of 36 German nouns and their corresponding gender. Eighteen target items were English-Swedish-German cognates (e.g., GER: *die.*$_{FEM}$ *Banane*; SWE: *bananen.*$_{COM}$; ENG: *the banana*) and the other 18 items were noncognates between German, English and Swedish (e.g., GER: *die.*$_{FEM}$ *Kerze*; SWE: *ljuset.*$_{NEUT}$; ENG: *the candle*). In the training period participants saw a picture of the noun, heard the noun and its gender, and then repeated the complete noun phrase. Each noun was repeated five times. Then participants completed two forced-choice tasks and a noun phrase production task to measure what they learned (Arnon & Ramscar, 2012). In the first forced-choice task participants saw a picture, heard two noun phrases embedded in the carrier phrase *Hier ist…* "Here is…" and had to judge which target sentence contained the target word that matched the picture on the screen. The second forced-choice task followed the same format but tested participants' knowledge of the target word's gender. In the noun phrase production task participants saw a picture and had to name the target picture with its correct gender. One week later participants returned to the lab and completed the forced-choice and noun phrase production tasks in a delayed posttest.

Preliminary results suggest that the L1 English speakers are more accurate in learning cognate words and their gender than non-cognate words, as measured by both forced-choice tasks and the production task, paralleling previous studies (e.g,. Perotti et al., 2013). However, in the delayed forced-choice task, gender accuracy stayed the same or improved for noncognates but decreased for noncognates. We hypothesize this is because the participants worked harder to learn the unfamiliar vocabulary (i.e., noncognates) during training, but relied on previous knowledge (i.e., L1 English representations) to remember cognate vocabulary, leading to greater consolidation of the gender for noncognates over time. If having grammatical gender in the L1 is beneficial for learning L2 gender, even among novice L2 learners, then we predict that the L1 Swedish participants will outperform the L1 English participants on gender accuracy in the testing phase (cf. Sabourin et al., 2006). Further, if gender assignment accuracy influences vocabulary learning more generally, we predict that the L1 Swedish participants will also be more accurate in vocabulary testing measures at the testing phase. Based on our preliminary findings, we also predict more accurate gender assignment and better vocabulary learning

for cognates versus non-cognates for both L1 groups, although among L1 Swedish participants,gender assignment accuracy could decrease on cognate items with conflicting gender between Swedish and German (e.g., Lemhöfer et al., 2008).

The Relationship between Saudi EFL Learners Strategies of Organizing the Mental Lexicon and the Quality of Listening and Reading Comprehension "An Experimental Study"

Faizah Alhammadi

The present study attempts to explore the lexical organization strategies employed by Saudi female students learning English as a Foreign Language, and how the various organization strategies relate to the process and the product of listening and reading comprehension. The lexical level was particularly chosen for the study on the basis of the importance of vocabulary acquisition and utilization in the process of language performance in general, and in the processes of listening and reading comprehension in particular. Two proficiency levels were investigated - low-proficient (represented by first year students), and high-proficient (represented by fourth year students). This was intended to investigate the variance in organization strategies in relation to EFL proficiency level. Ninety (90) students were randomly selected from the class roster to participate in the experiment, 45 from the first year, and 45 from the fourth year. The study employs an experimental methodology in which the Learners' scores in the various lexical organization strategies are first characterized , then they are correlated with the learner's speed and accuracy in TL listening and reading comprehension. In other words, three experimental tasks were designed for the purposes of the present study; a lexical decision task to probe the lexical organization strategies, a reading comprehension task, and a listening comprehension task. Four lexical organization strategies were investigated through word recognition latencies: interlingual semantic, interlingual phonetic, intralingualsemantic, and intralingual phonetic strategies. The speed and accuracy (depth) of listening and reading comprehension were investigated through objective validated tests, and the scores were correlated to the various lexical organization strategies. It was found that the sample's reading and listening speed is much lower than that of the average native speaker of English. It was also found that interlingual organization strategies were more dominant in low-proficient learners than in high- proficient learners who mainly adopted intralingual organization strategies. Experimental results revealed that the various organization strategies are not mutually exclusive, and that intralingual strategies yield faster and better comprehension compared with interlingual strategies.

The results show that proficiency level of the bilingual learner determines the lexical organization strategies he/she will adopt. Interlingual strategies are more dominant in beginning stages of learning. Another important finding is that direct and indirect accesses to the target language lexicon are not mutually exclusive. Accessing the target language lexicon via the first language lexicon depends on such factors as the nature of the lexical task, and the processing load demanded by that task. Furthermore, the results of the present study point to the important place of vocabulary acquisition and utilization in the process of language performance. This makes the teaching and learning of vocabulary one of the most important goals of foreign language pedagogy. As far as the present study population is concerned, more attention should be given to the development of reading speed and the ability to guess and predict through the utilization of scripts, schemas and scenarios. More attention should also be given to fostering intralingual lexical organization by introducing and practicing new vocabulary items within semantic domains.

The Paradigmatic Lexicon: Morphological processing in a complex verbal system

Joyce McDonough

In this study, a model of morphological processing elucidated by Schreuder & Baayen (1992) for English and Dutch, is extended it to a highly complex morphological system, the Athabaskan verb, with predictions for lexical access and learnability, extended to languages with dense paradigmatic variability. This model stands in contrast to models in which words are decomposed on the fly and governed by syntagmatic properties, such as in Distributed Morphology (Halle & Marantz, 1993). In the Schreuder-Baayen (S-B) model, word processing is tuned to the particular distributional and structural properties of a language via a activation feedback system consisting of three types of nodes, form and meaning nodes, and crucially an intermediate node that codes prelexical concepts which develop from lexical patterns and provides a layer of intervention which is the basis of sound form change. In this view all morphological processing is a process of calculating meaning from form. The model was established as a meta-model for lexical activation in morphology, with two principle characteristics important to the present discussion.

- input to the model is speech, linking sound forms and meaning.
- based on the identification of morphologically licit forms, including bound and free forms as well as fully inflected words

The S-B model addresses critical issues in processing of complex verbal morphologies:

- non-transparency of full forms, which depends on the linking of non-compositional semantic meaning to full forms
- processing of novel forms, which is dependent on inherent productivity (transparency) of the word formation system
- role of frequency in morphological change and lexical access

In the forms below from Navajo (Young and Morgan (Y&M) 1987) *ch'ininiskkaad* is a non transparent form translated as 'I herded them out (horizontally)' (Y&M:332), composed of at least two clearly identifiable components *ch'inis* and *kaad*, estab-

lished by clear phonetic, phonotactic and semantic/syntactic patterns. Both subcomponents participate in combination with other forms, the combinations are at best semi-transparent but with clear structural properties that serve as a base for novel forms.

Y&M:291 ch'ininish- Y&M:332 -kaad
flee *ch'ininisdzóód* drop downward *naashkaad*
drive out animal *ch'ininischééh* drive off attackers *'ák'inishkaad*
lure him out *ch'ininish'ááh* cover him *bik'inshkaad*
stick head out *ch'ininish'nééh* keep it *besélkaad*

containing as well as segmentable subparts that are moderated by feedback from full forms, mediated by concept nodes and subject to frequency effects:

ch'í ch'íni nish nínish

The goal of the talk is to demonstrate the common characteristics of the Athabaskan system and, by extension, other richly inflectional systems, to the better studied but more analytic morphologies, and to lay out the predictions it makes for 1) lexical access and word formation, 2) frequency effects and change and 3) importantly, acquisition and leaning.

Separating Segmental and Tonal Information in Visual Word Recognition with Second Language Learners of Chinese

Joshua Davis, Min Wang

Models of visual word recognition have demonstrated that phonological information is activated in visual word recognition when reading alphabetic writing systems while later research demonstrates that this activation occurs in a similar fashion when reading Chinese characters, a non-alphabetic writing system. Previous research that examines the role of phonology in reading Chinese characters does so primarily at the segmental (S) level while comparatively few studies have addressed the role of tonal (T) information.

Among the few to directly examine the role of tonal information in reading Chinese characters is Li et al., (2013), who used a Stroop paradigm using Chinese characters to quantify the relative contribution of segmental and tonal information in reading by using near- neighbors of the ink color of Chinese characters to provide lexical competitors in naming. For example, 红 (hong2) means *red* and participants were provided with various permutations of Chinese characters that were matched against the ink color of the word (e.g., 红-*hong2*, color character; 洪-hong2, S+T+; 轰-*hong1*, S+T-; 瓶-*ping2*, S-T+; and 贯-*guan4*, S-T-, all written in red font). The researchers found significant facilitation for homophonic characters and both variations of partial homophones, suggesting that segmental and tonal information are activated automatically and independently of one another.

While previous research has given some attention to the role of tonal information in reading in Chinese, less focus has been placed on the process of reading Chinese from the perspective of a Chinese language learner both in terms of their processing of tonal and segmental information and the role that Pinyin (a transcription system that Romanizes Chinese characters) has on these processes. Alphabetic languages typically lack tonal features that explicitly dictate meaning, and so the present

study aimed to answer the question of the nature of tonal representations for the Chinese language learner. This study used a modified homophone judgment task that matches two Chinese characters based on conditions similar to those manipulated in Li et al (2013) including the S+T+, S+T-, S-T+, S-T- conditions. In addition to the dual Chinese character condition, we also had a character-Pinyin condition to address the relative facilitation that learners experienced from Pinyin in word recognition. Participants in this study were divided into three categories: intermediate and advanced Chinese language learners and native Chinese speakers who will serve as a control group. Our expectations are threefold: first, the S+T- condition will slow down both native speakers and language learners' judgment of whether or not the two characters are homophones; second, segmental information will play a larger role in reading than tonal information for language learners compared with native Chinese speakers; third, Pinyin will provide a strong facilitative effect for Chinese language learners.

Pilot data showed that while native speakers were faster at homophone judgment than second language learners, for the S+T+ (a "yes" response) and S+T- (a "no response) conditions, both groups showed interference compared to the S-T- baseline. Participant groups differed noticeably in the S-T+ condition. While native speakers experienced the same pattern of interference as the S+T- condition when compared with the baseline, the second language learners actually showed a facilitation effect in the same comparison. This may indicate that native English readers are more sensitive to differences in segmental information and are largely insensitive to tonal information compared to native Chinese readers, even at high proficiency levels in Chinese.

Platform Session 2.4

Embodiment of Verb Meaning
Penny Pexman, David Sidhu, Paul Siakaluk

Research examining semantic richness effects in visual word recognition has shown that multiple dimensions of meaning are activated in the process of word recognition (e.g., Yap et al., 2012). This research has, however, been limited to nouns. In the present research we extended the semantic richness approach to verb stimuli in order to investigate how verb meanings are represented. We characterized a dimension of relative embodiment for verbs (the extent to which the meaning of each verb involved the human body), based on the bodily sense described by Borghi and Cimatti (2010), and collected ratings on that dimension for 687 English verbs. The relative embodiment ratings revealed that bodily experience was judged to be more important to the meanings of some verbs (e.g., dance, breathe) than to others (e.g., evaporate, expect). We then tested the effects of relative embodiment on verb processing in lexical decision (Experiment 1), action picture naming (Experiment 2), syntactic classification (Experiment 3), and recognition memory (Experiment 4). In all four experiments results showed facilitatory effects of relative embodiment: response latencies were faster and recognition memory more accurate for relatively more embodied verbs, even after several other lexical and semantic variables were controlled. The results suggest that relative embodiment is an important aspect of verb meaning, one that skilled readers access when making lexical or semantic decisions, naming pictured actions, and in recognition memory. As such, the semantic richness approach holds promise as a strategy for investigating other aspects of verb meaning.

The role of semantic richness in processing reduced and canonical forms in spoken word recognition
Cynthia Connine, Stanislav Sajin

The production of conversational speech is highly variable and spoken words often undergo reduction (shortened or deleted syllables or segments). Reduced spoken words deviate from full or canonical form and are generally more difficult to recognize than their canonical counterparts (Ernestus, Baayen & Schreuder, 2002). The goal of the current experiments was to investigate the contribution of enriched lexical semantics to processing reduced and canonical forms. In the experiments, lexical semantics was indexed by sensory experience ratings (SER), a semantic richness metric found to facilitate visual word recognition (Zdrazilova & Pexman, 2013). Recent models of spoken word recognition postulate that lexical semantics directly influences activation of phonological representations (Chen & Mirman, 2012). A direct role of semantics in spoken word recognition would suggest that rich lexical semantics may enhance processing of reduced productions.

The role of SER in processing spoken words was investigated for two types of reduction, two syllable words with word final [t] deletion (e.g. blanket) and medial flaps (e.g. pretty). A set of high and low SER rated words were selected for each reduction type. Within a reduction type, high and low SER sets, words were equated for Age of Acquisition, Subtitle Frequency, concreteness, and familiarity. Canonical and reduced forms were recorded by a native speaker of American English and presented

to listeners who performed a lexical decision task. An additional set of unreduced productions of words and nonwords were selected and served as fillers.

Words with enriched lexical semantics (high SER) were processed faster than words with impoverished lexical semantics. Medial flap words and t-deletion words also showed an interaction of lexical semantics and word form but the nature of the interaction differed. For medial flaps, semantics mattered for canonical but not for reduced productions: high SER words were processed faster than low SER words for canonical productions but there was no influence of semantics for reduced productions. In contrast, for t-deletion words, semantics mattered for reduced but not for canonical productions: high SER words were processed faster than low SER words only for reduced productions. The findings suggest that enriched lexical semantics facilitates processing of both canonical and reduced forms of spoken words. The results are discussed in terms of differences in the distributional properties for different kinds of reduction.

The role of semantic diversity across aging and bilingualism

Brendan Johns, Christine Sheppard, Michael Jones, Vanessa Taler

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Platform Session 2.5

16.10—16.30

Medial stop reduction and word recognition "in the wild"

Benjamin V. Tucker, Daniel Brenner, Michelle Sims

16.50—17:10

The Influence of High Variability Exposure Conditions on Talker-specific versus Talker-independent Perceptual Learning Outcomes

Kodi Weatherholtz

16.30—16.50

Privileged vs. shared knowledge effects on phonological competition

Mindaugas Mozuraitis, Craig G. Chambers, Meredyth Daneman

15.40—16:00

Morphological Boundaries in Phonological Processing

Ariel Cohen-Goldberg, Naomi Caselli, Michele Miozzo

Medial stop reduction and word recognition "in the wild"
Benjamin V. Tucker, Daniel Brenner, Michelle Sims

Research on laboratory speech has uncovered many aspects of speech perception and comprehension, however we still know very little about the recognition of the more common spontaneous types of speech. This presentation reports an experiment designed to investigate the relationship between word-medial stop production variability and word recognition. Specifically, this experiment tests whether there is a relationship between the production frequency and the range of variation in the production of word medial stops which directly affects recognition.

In spontaneous speech, speakers often produce "reduced" speech forms: for example, a phrase like "Did you eat yet?" is often produced as [dʒitʔjɛtʔ] or "jeet yet?" Reductions are extremely common in everyday speech. One study of conversational speech found that 25% of word tokens differ from their dictionary pronunciation (Dilts, 2013). Research on this topic has repeatedly shown that reduced speech is more difficult to process than unreduced speech (e.g., Ernestus et al., 2002; Tucker, 2011; Ven et al., 2011). These studies generally have dichotomized reduction into two groups, reduced and unreduced. Tucker (2011) also found in a post-hoc analysis of the lexical decision latencies that by using an acoustic measure to represent the range of reductions that a possible non-linear relationship emerges between reduction and response latencies. This non-linear relationship may indicate that words produced with their most frequent pronunciation variation elicit the fastest responses, however the stimuli used in Tucker (2011) were not designed to specifically investigate a correlation between a gradient acoustic measure, intensity difference, and response latency. It is also possible that the unreduced form is the lexically stored form and that when using a gradient acoustic measure the more deviant the input is from that unreduced form the slower the response time will be resulting in a more linear type of response.

The present study, then, directly tests the distributional hypothesis implied by Tucker (2011) by using a large variety of word-medial stops, which cover the full production spectrum (reduced, unreduced, and everything in between). Items were selected from a corpus of spontaneous speech allowing for access to a much broader array of stop production compared to the dichotomous distribution used in Tucker (2011). In following part of Ernestus et al. (2002)'s methodology, we extracted words containing word-medial stops in three different contextual environments: "isolation", "phonological", and "phrasal" contexts. Unlike the methodology used in Ernestus et al. (2002), we conducted a cross-modal identity priming experiment, which allows for a more direct investigation into processing load (and yields a more refined measure than a word identification task). Seventeen native English listeners have participated in the experiment, with each participant responded to a total of 366 items (54 identity primes, 54 controls, 60 with phonological overlap, 36 "yes" distractors and 162 non-words).

Initial results indicate that some degree of context surrounding the target word facilitates recognition (e.g. the phonological context), however in the full context, responses were slower than the other contexts, likely due to the increased amount of lexical competition by the introduction of more words. Overall we find support for previous work: generally, more reduced items are more difficult to process. It is notable that unlike Tucker (2011),

we do not find any non-linear relationship between our reduction measure (intensity difference) and response time, but we find a linear relationship which we interpret as indicating that it is indeed the unreduced form that is stored as opposed to the more distributionally valid form of the word.

Privileged vs. shared knowledge effects on phonological competition
Mindaugas Mozuraitis, Craig G. Chambers, Meredyth Daneman

Spoken word recognition involves the incremental mapping of speech sounds to word forms stored in the mental lexicon, and forms with overlapping sounds compete for activation as the speech signal unfolds. An outstanding question, however, is to what degree lexical competition is influenced by conversational factors such as perspective differences among different individuals. The current study investigates this topic by varying whether the potential for lexical candidates to compete depends on what the listener knows about the speaker's knowledge state.

A visual world methodology was adopted using real objects, some of which were visually- misleading (e.g., a yo-yo that looks like a baseball). A pretest confirmed that our selected misleading objects would be misidentified based on their appearance. The materials were then used alongside other objects in an on-line referential communication experiment in which participant-listeners followed instructions from a (confederate) speaker in a different room via video-chat (e.g., "pick up the yogourt and put it…"). We manipulated (i) competitor type and (ii) the knowledge that could be attributed to the speaker (listeners always knew the actual identity of misleading objects). Competitors were either *"regular"* phonological competitors for the target word (actual yo-yo) or *"misleading"* objects (yo-yo that looks like a baseball) whose status as a phonological competitor depends on knowing the object's true identity. A third competitor type consisted of *visual control* objects (e.g., actual baseball) to establish a no- competition baseline. In the *shared-knowledge* condition, the true identity of misleading competitors was revealed to both listener and speaker before each trial while the video-chat system was online. In the *privileged-knowledge* con-

dition, the identity of misleading competitors was revealed only to listeners before each trial, while the video-chat system was temporarily paused. Thus, in this condition, listeners are aware that the word form corresponding to the misleading object's real identity could not plausibly be selected by the speaker to refer to that object.

The shared-knowledge condition showed classic phonological competition effects as the target noun unfolded, with considerable visual consideration of the 'regular' competitor and little for the visual control object (p<.05). Interestingly, for the misleading phonological competitor, the listeners' visual consideration was higher compared to the visual control object (p<.05) and not different from the regular phonological competitor (p>.05). This suggests that when the knowledge about the misleading object's true identity is shared, the object's name is fully active in the arena of lexical competition. Somewhat surprisingly, in the privileged-knowledge condition, the pattern of visual consideration of the competitor objects was similar to that in the shared-knowledge condition. Thus, even though the listener knew that the speaker could not refer to the misleading competitor as a "yo-yo" because the speaker would consider it to be a baseball, the word form "yo-yo" appeared to be activated for the competitor object as the target name was heard. The results demonstrate that the degree to which word forms with overlapping sounds compete for activation as the speech signal unfolds is largely unaffected by knowledge about the speaker's perspective regarding the identity of objects and instead is strongly driven by the listener's personal knowledge state.

The Influence of High Variability Exposure Conditions on Talker-specific versus Talker-independent Perceptual Learning Outcomes
Kodi Weatherholtz

Perceptual learning is a powerful mechanism that tailors speech perception to the environment by identifying and adjusting for patterns of pronunciation variation in ambient speech (Norris et al, 2003). Previous research has investigated whether adjustments resulting from experience with a particular talker are applied talker-specifically or whether these adjustments are talker-independent, transferring to new talkers who produce similar patterns of variation. Currently, evidence for talker- independent learning is mixed. Some results suggest that multi-talker exposure is a necessary condition for talker-independent learning outcomes, at least when adapting to a foreign accent (Bradlow & Bent, 2008). Other studies have shown talker-independent learning following single- talker exposure, at least when adapting to atypical native variation (Kraljic & Samuel, 2006).

The current study investigates the influence of initial exposure conditions on the specificity of perceptual learning out-

comes. The general hypothesis is that high variability exposure conditions promote robust talker-independent learning of segmental variation, such as vowel variation due to a talker's accent. Multi-talker exposure (as in B&B, 2008) is one type of high variability context. Another type, and the focus of the current study, is single-taker conditions in which listeners experience a given segmental variant in a wide range of lexical and phontactic contexts. The basic hypothesis is that experiencing a segmental variant in a wide range of contexts enables listeners to abstract a general representation that captures the underlying pattern of variation, along with knowledge of the range of variability associated with this pattern. That is, with sufficient exposure, listeners develop a representation that abstracts away from talker-specific properties of the segmental variant, enabling cross-talker transfer of learning.

Two experiments test this hypothesis using a between subjects version of Maye et al.'s (2008) exposure-test vowel adapta-

tion paradigm. For the exposure phase, participants passively listened to a 20-minute story spoken by a female with a novel English accent, characterized by a clockwise back vowel lowered chain shift of the vowels /u, ʊ, o, ɔ/ (e.g., /u/ as in goose sounded more like [ʊ] as in good; /ʊ/ sounded more like [o] as in goat, etc.). The exposure passage contained several hundred instances of words pronounced with shifted vowels. A separate control group heard the same talker read the same story but in a standard-sounding American English accent. The test phase was an auditory lexical decision task containing back vowel lowered word forms as test items along with filler words and nonwords. In Experiment 1 (N = 27), half of the critical items were produced by the trained female and half by a new female (presentation blocked by talker). Experiment 2 (N = 30) was identical except the new talker was male. Greater endorsement (i.e., 'word' response) of vowel- shifted forms in the experimental versus control condition is taken as evidence of perceptual learning.

Lexical decisions were analyzed using mixed logit regression with the maximal random effect structure justified by the design. In both experiments, participants were significantly more likely to endorse the trained talker's back vowel lowered pronunciations following exposure to this novel chain shift than following exposure to the same talker with standard-sounding vowels (ßs > 0.36, zs >2.8, ps < .01), indicating perceptual learning of the novel vowel system. Further, participants endorsed significantly more back vowel lowered forms from both the new female talker (Exp1) and the new male talker (Exp2) in the experimental versus control exposure conditions (ßs > 0.25, zs >2.2, ps < .05), indicating cross-talker transfer of learning. Consistent with the hypothesis above, these results indicate that high variability exposure conditions can induce talker-independent perceptual learning. A follow up study is in progress to determine whether talker-specific learning is observed under low variability exposure conditions.

Morphological Boundaries in Phonological Processing

Ariel Cohen-Goldberg, Naomi Caselli, Michele Miozzo

The question of how morphological structure influences phonetic form has been the subject of a small but increasing debate in the spoken production literature. Some studies have found evidence that the phonetics of mono- and multimorphemic words differ from each other. For example, a handful of studies have found that root and suffix phonemes are longer in suffixed words than homophonic monomorphemic words (e.g., *passed* > *past*; *laps* > *lapse*; Frazier, 2006; Hay, 2007; Losiewicz, 1995; Song, Demuth, Evans & Shattuck-Hufnagel, 2013; Sughara & Turk, 2009; Walsh & Parker, 1983) and that true affixes have different durations from pseudo-affixes (e.g., discolor vs. discover; Smith, Baker, & Hawkins, 2012). Other studies have found differences in the articulation of mono- and multimorphemic words (Cho, 2001) and differences in the application of phonetic rules across morpheme boundaries of varying strengths (Hay, 2003).

At the same time, a growing number of studies have failed to find such differences or have found effects that run in the opposite direction (e.g., Bürki, Ernestus, Gendrot, Fougeron, & Frauenfelder, 2011; Hanique & Ernestus, 2012; Schuppler, van Dommelen, Koreman, & Ernestus, 2012).

In the present investigation, we examined how morpheme boundaries influence phonetic processing in American English. Using the Buckeye corpus of spontaneous speech, we examined intervocalic tapping (city → [sɪɾi], sitting → [sɪɾɪŋ]) and word-final /t/-deletion (tract → [træk], cracked → [kræk]).

Using mixed-effects modeling, we find that intervocalic tapping occurs significantly less frequently across suffix boundaries (72%) than within morphemes (81%). In the analysis of word-final /t/-deletion, we replicate the standard effects of morphology (past tense deletes at a lower rate than non-morphemic /t,d/) and phonology (deletion is less likely given a following consonant-initial word than a vowel-initial word). We report a novel interaction of morphology and phonology where suffixed words are significantly less likely than unsuffixed words to delete before vowel-initial words. Further analysis suggests that these results are not reducible to long-term contextual conditioning (Bybee, 2002) and are in fact related to resyllabification (deletion is more frequent before words beginning with /l/ than /r/, consistent with the fact that /tr/ and /dr/ are legal onsets but */tl/ and */dl/ are not).

These results provide evidence that morphological structure influences the phonetic form of American English words. Furthermore, they suggest that phonological representations may contain weaknesses at morphological boundaries. In the case of intervocalic tapping, it appears that the process responsible for tapping applies more weakly across morpheme boundaries, consistent with the notion that phonemes in different morphemes are not as tightly bound to each other. In the /t/-deletion analysis, the data suggest that suffixes are more able to resyllabify into the onset of a following word than non-morphemic /t,d/, consistent with the notion that multimorphemic words may contain 'fault-lines' at morpheme boundaries and are hence more divisible (e.g., Cohen-Goldberg, Cholin, Miozzo & Rapp, 2013).

Thursday, October 2nd
Platform Session 3.1

09.00—09.20

Bilingual lexical access: The gender transfer – gender default paradox

Rachel Klassen, Juana Liceras

09.20—09.40

Do bilinguals lag behind monolingual children in semantic development? Evidence from a narrative task

Poliana Barbosa, Elena Nicoladis

09.40—10:00

Online sound-to-print word recognition in second language: the role of the acoustic cues for stress in L1 vs. L2

Amanda Post Da Silveira

The Role of Motor-Relatedness and Priming Type in the Processing of Dutch Derived Verbs

Sophie De Grauwe, Kristin Lemhöfer, Herbert Schriefers

Previous L2 research has shown pervasive effects of L1 transfer in the use of grammatical gender in the L2. L1 speakers of languages with grammatical gender (such as Spanish) tend to transfer L1 gender information into the L2 (Sabourin et al, 2006) while L1 speakers of languages without grammatical gender (such as English) opt for a masculine-as-default strategy (Franceschina, 2001). Effects of the L1 gender system (or lack thereof) have also been shown in code-switching research. Functional-lexical switches, such as those within the Determiner Phrase (DP), show that L1 Spanish speakers prefer switches in which the determiner matches the gender of the translation equivalent noun (as in

1). L1 English speakers, on the other hand, demonstrate a masculine-as-default strategy, consistently opting for the masculine determiner form (as in 2) (Liceras et al, 2008).

(1) El [the$_M$] book [libro$_M$] / La [the$_F$] door [puerta$_F$]
(2) El [the$_F$] book [libro$_M$] / El [the$_M$] door [puerta$_F$]

Numerous bilingual lexical access studies have shown that speakers of two languages with grammatical gender have an L1-L2 shared representation of grammatical gender (Paolieri et al, 2010). Recent work has extended these findings to speakers of languages with asymmetric gender systems, such as Spanish (two-class) and German (three-class), providing evidence of an L1-L2 shared gender system for genders common to both languages and a unique representation for the asymmetric gender (neuter) that interferes in language production significantly less than L1-L2 masculine/feminine incongruent nouns (Klassen,

2013).

To further inform the nature of asymmetric grammatical gender systems in bilinguals, we carried out an L2 picture-naming study in which 19 L1 Spanish-L2 German speakers and 25 L1 German controls named pictures in German by producing a DP. Stimuli were line drawings of inanimate nouns of the same gender in Spanish and German (congruent) or of different genders (incongruent). An analysis of errors was carried out on the incongruent stimuli. Error rates indicated that the masculine determiner was the most erroneously produced form, despite the fact that errors with masculine could only be attributed to L1 transfer in two (A & C) of the three conditions where masculine was non-target (3). RTs for errors revealed that production of the masculine determiner did not differ significantly across the non-target conditions (4), regardless of the differing status of masculine (transfer *vs* M as default).

The consistent use of masculine even when this would not result from L1 transfer (Condition D), offers new evidence of the use of masculine-as-default by L1 speakers of a 2-class gender language (such as Spanish) learning a 3-class gender language (such as German). The fact that RTs are the same to produce the masculine determiner even in Condition D where the masculine gender node receives no activation from L1 or L2 suggests that the nature of the L1-L2 asymmetric gender representation allows masculine-as-default as a viable option, despite the cost compared to L1 transfer (F in Condition D).

(3) total error rates by gender

▲ = L1 transfer/M default

Condition		der (M)		die (F)		das (N)
A	L1 M – L2 F	71.8%	▲	target	---	30.6%
B	L1 F – L2 M	target	---	53.6%	transfer	46.4%
C	L1 M – L2 N	78.8%	▲	21.2%	---	target
D	L1 F – L2 N	63.3%	M default	36.7%	transfer	target
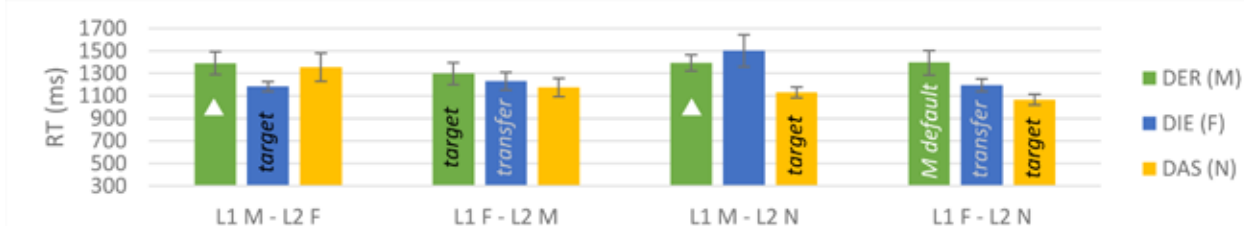
(4) RTs by gender

Do bilinguals lag behind monolingual children in semantic development? Evidence from a narrative task

Poliana Barbosa, Elena Nicoladis

Bilingual children often score lower on vocabulary tests than monolinguals of both languages (Bialystok, Luk, Peets, & Yang, 2010). Perhaps in part because of lower vocabularies, during the middle childhood, bilingual children show delay in semantic development, notably in the shift from schematic to categorical responses (once called the paradigmatic-syntagmatic shift; Yan & Nicoladis, 2009). Schematic responses are based on associations between the target word and words for objects in the world (Perraudin & Mounoud, 2009). For example, for a target

word "dog", a child might say "bone". Categorical responses take into account the taxonomic relation between words (Perraudin & Mounoud, 2009). For example, a child might say "cat" or "animal" for the target "dog". This shift between schematic and categorical organization of words in the mental lexicon is expected to take place around 7-8 years of age (Danovitch & Keil, 2004; Perraudin & Mounoud, 2009). Around that age, bilinguals give more schematic responses than monolinguals, consistent with a delay in semantic development (Yan & Nicoladis, 2009).

Studies showing a bilingual delay in semantic development have relied on single word access tasks, like picture naming (Yan & Nicoladis, 2009). The objective of this study is to investigate whether bilinguals will show the same lag in semantic development relative to monolinguals in the context of telling a narrative. In telling a story, adults often use basic-level words, unless they wish to make a rhetorical point. However, if storytellers do not know the target words, they could simply leave out reference to events or objects. Alternatively, they could use compensatory strategies, such as a lot of categorical responses (like "animal" for a dog), light verbs (e.g., "go" instead of "run"), or descriptions of the target.

We conducted 3 studies in which the participants were invited to watch a Pink Panther carton and retell the story. We identified 12 target words that were important in telling the story (6 verbs and 6 nouns) and we coded participants' lexicalization of this words as: target words, categorical responses for nouns (use of superordinate or taxonomic related word, e.g., "cat" for the target "Panther"), light verbs (use of more general meaning verbs, e.g., "puts" for the target "throws") and creative responses (use of descriptions, e.g., "that little bird that leaves inside a clock and sings" for the target "cuckoo clock"). In Study 1 we compared younger (3-5 year olds) and older (8-10 years old) English mono-

lingual children in order to characterize what would be a delay. Younger children tended to do not lexicalize the unknown target words, that is, to avoid them. In Study 2 we compared English second language learners adults to English monolingual children (8-10 years olds). In this case, the adults did try to lexicalize the target words, using compensatory strategies such as creative responses. Finally, in Study 3, we compared French-English bilingual children to English and French monolinguals, all of the same age range (7-8 years). The bilinguals did produce fewer target responses than the monolinguals. However, their lexical choices when not producing the target word resembled the adults in Study 2 more than the younger children in Study 1. That is, the bilingual children tended to produce more categorical responses for nouns and more light verbs than monolinguals, consistent with more advanced semantic development than monolinguals. That is, these findings contradict previous findings with single word tasks.

In the context of a narrative task, bilingual children can use compensatory strategies when accessing an unknown word in their mental lexicon, and do not appear to lag behind monolinguals in the shift from schematic related responses to categorical ones.

Online sound-to-print word recognition in second language: the role of the acoustic cues for stress in L1 vs. L2

Amanda Post Da Silveira

The use of lexical stress in auditory word recognition is very often accounted to occur later in the recognition process than segmental information (Cutler 1986). However, spectral information (e.g. the degree of reduction, which is language specific) seems to be an attribute of stress, since the full vowel range of a language occurs only in stressed position (Sluijter et al 1997). English and Portuguese follow different patterns for the relationship spectral reduction vs. stress. In English, pre-tonic vowels reduce to schwas, while in Brazilian Portuguese the reduction occurs only in terms of vowel duration and not spectra. BP learners of English tend to categorize the reduced vowels of English to their full forms both in production and in perception, so that the first syllable of the word pair *advertise-advantage* would sound the same. Our interest is to investigate whether learners are able to perform an online recognition of English words based on their suprasegmental information of L2, which includes the relationship with spectral reduction of English. We developed a visual world paradigm eye tracking experiment which tested the time in which English native and non-native

listeners make use of spectral reduction cue for stress. The first experiment included 360 3-syllable words divided into 4 categories built by the manipulation of two variables: 1) segmental overlap and ii) stress overlap on the first syllable words of English. In native English, fixations on targets such as "ADjective" were more frequent than fixations on segmentally overlapping, but second syllable stressed competitors, such as "adVANtage", before segmental information could disambiguate the words, corroborating the results by Reinisch et al (2010) for Dutch. Brazilian listeners of English, on the other hand, gave the same amount of looks to target-competitor alike, indicating that vowel reduction was not a cue for unstressed syllables in their L1-L2 associated system. Production data shows that reductions in pre-final position are rare in Brazilian-English, reflecting patterns of L1 Brazilian Portuguese. Native English listeners recognize words by immediately using all relevant acoustic cues from the speech signal, while English L2 listeners do not recognize the same acoustic information as relevant for word recognition in L2.

Poster Session 3.1

10.00—11.00

Picture naming in the L1: Evidence from Monolinguals, Bilinguals, and Trilinguals

Gregory J. Poarch, Margot D. Sullivan, Ellen Bialystok

A robust finding in bilingualism research is that bilinguals display a linguistic disadvantage in lexical access compared to monolinguals. More specifically, there is converging evidence for slower lexical retrieval even when words are retrieved in the bilinguals' dominant language (e.g., in picture naming tasks), both for child bilinguals (Poarch & Van Hell, 2012) and adults (Ivanova & Costa, 2008). This bilingual disadvantage has been explained by two views: it has been attributed to (1) the weaker-

links hypothesis, in which bilinguals accrue a relatively lower frequency for all mental lexicon entries based on the need to divide usage between two languages (Gollan et al., 2008, 2011), or (2) the competition account, in which access to the bilingual lexical is impeded by cross-language competition from two jointly activated languages and subsequent conflict resolution (Green, 1998, Green & Abutalebi, 2013).

However, so far there has been little focus on trilinguals, who, given their need to control and divide their word frequency between three languages, should show a greater disadvantage in lexical retrieval due to even weaker links but no additional deficit from competition. The present study explored whether the bilingual disadvantage in lexical retrieval extends to trilinguals.

107 adults participated in the study comprising monolinguals, bilinguals, and trilinguals. The participants completed measures of vocabulary in English (PPVT-III) and nonverbal fluid intelligence (KBIT), and performed a picture-naming task with high- and low-frequency stimuli. Bilinguals and trilinguals named high- and low-frequency pictures slower and less accurately than monolinguals, but, critically, bilinguals and trilinguals did not differ in their naming performances. These results indicate a better fit for the competition account and are discussed against the backdrop of current models of bilingual language retrieval. Moreover, the results also demonstrate that sustained processing of more than two languages leads to no extended disadvantage over processing only two languages.

Can (un)masked primes leave an episodic memory trace?
Lien Van Abbenyen, Dominiek Sandra, Kenneth Forster

The masked priming paradigm (Forster & Davis, 1984), was developed as a technique to get insight into the internal structure of the mental lexicon. According to their *prospective, lexical account*, target processing benefits from a related masked prime, because the prime preactivates the target's lexical representation. Since participants don't consciously see the prime, they cannot anticipate the target or develop response strategies – hence, the effects emerge without participants' awareness. The use of this paradigm has been particularly successful in different domains of psycholinguistic research. However, the lexical nature of the masked priming effects has been challenged by Bodner & Masson's (B&M; 1997) *retrospective account*. They claim that the masked prime creates a trace in episodic memory, which can subsequently be accessed by the target. In their view, the target is not preactivated by the prime. However, when an unconscious checking system discovers a relation between the target and the preceding prime's episodic trace, a faster decision is made.

The purpose of our current experiments is to find out whether briefly presented primes do leave an episodic trace themselves.

In a series of experiment, we investigate this in two different tasks: first in an unmasked and masked episodic recognition task [ERT], and later on in a lexical decision task [LDT]. An ERT requires activation of episodic memory, and should offer a higher probability for discovering episodic traces left by masked words. In the LDT, we will investigate the creation of episodic traces in masked lexical tasks in which activation of episodic memory is not logically required. If we were to find that masked primes leave an episodic trace (which implies activation of episodic memory) during a LDT, we can no longer deny a role of episodic memory during masked priming experiments and would be no longer able to defend a straightforward lexical account of masked priming effects.

So far, we have completed the unmasked and masked ERTs. Participants were presented with a simple task: two sequences followed each other immediately, with a 500ms interval. Their task was to decide whether the two targets were the same or not. If the first sequence leaves an episodic trace of the prime-target association (masked or unmasked), then the exact repetition of this sequence (apple TREE - #### apple TREE) should facilitate yes responses relative to a control condition (apple TREE - #### coffee TREE). This would prove that a masked prime leaves its own episodic trace. In none of the ERTs, however, did we find any trace of episodic priming, not even in the unmasked version of the experiment. This was highly unexpected and suggests that primes don't leave episodic traces themselves, not even in an unmasked priming experiment. These results are interesting, as they can't be explained by either the *retrospective* or the *prospective account*. A follow-up study is needed and in progress.

Cross-linguistic MMN studies of allophonic durational differences
Adam Roberts, Allison Wetterlin, Sandra Kotzor, Aditi Lahiri

Perceptual asymmetries are seen in a wide variety of visual attention tasks, commonly referred to as "pop-out" where a target with an additional feature is easier to detect among a set of distractors that lack that feature than a target with a missing feature. Similar perceptual asymmetries have been demonstrated in audition using behavioural methods for both FM modulated tones vs unmodulated tones and for differences in duration in simple tones (Cusack & Carlyon 2003). Jaramillo et al (1999) demonstrated that the basic durational auditory asymmetry is pre-attentive in nature, by utilising the Mismatch Negativity (MMN) component of the evoked auditory ERP (Event Related

Potential), which is often used as an index of automatic auditory change detection. Increases in tone duration were more easily detectable than decreases in tone duration and gave greater amplitude MMN responses.

In speech, durational differences can lead to categorical contrasts in perception, such as voice onset time differences in voiced and unvoiced consonants and consonantal durational differences between singleton and geminate consonants. Finnish is one of many languages where vowel length is contrastive, e.g. /tuli/ [short] = 'fire' vs. /tu:li/ [long] = 'wind'. Jaramillo (1999) examined pre-attentive processing of vowel length in Finnish

and found asymmetric processing of duration, where shorter vowels elicit larger MMNs than longer vowel deviants.

The present study examines monosyllabic words in two languages that do not have phonologically contrastive vowel length (Bengali and English). In English vowel quantity changes accompany vowel quality changes (e.g. bit vs. beat) and in Bengali vowel lengthening applies in monosyllabic words, so that all monosyllables have long vowels. However, both languages exhibit allophonic differences in vowel length. All vowels before voiced consonants are longer than vowels before unvoiced consonants (Klatt, 1973), this applies to Bengali polysyllabic words but not to monosyllables where all vowels are long. We conducted an ERP study and measured MMN responses in English and Bengali native speakers for vowel duration changes (increases and decreases) in the pseudowords *chak* and *chag*.

In both language groups, all deviant stimuli elicited MMN responses indicating that both increases and decreases in vowel duration were pre-attentively discriminated. For the Bengali speakers, both amplitudes and latencies showed an effect of vowel length consistent with previous studies, with short vowels giving higher amplitude and slower latency peaks, reflecting the fact that short vowels are atypical in monosyllables in Bengali. However, as could be expected because of the allophonic difference, English speakers showed an interaction of vowel duration and consonant type, where vowel length affected latency only in the context of a following voiced consonant /g/. That is, for the pseudoword *chag*, long vowel deviants elicited a short latency MMN and short vowel deviants elicited a longer latency peak since they are atypical for English in this context. But for the pseudoword *chak*, both vowel deviants elicited the same latency MMN. The results here suggest that the MMN indexes both acceptability of pseudowords and durational differences, and these effects can be additive or subtractive in MMN latency.

Strategic modulation effects in implicit semantic tasks

Ashley Danguecan, Lori Buchanan

The automaticity of semantic processing has frequently been studied using semantic priming methodology, though results from certain task manipulations have challenged the notion that semantic processing is fully automatic. For example, priming effects can be largely reduced or eliminated when a letter search task is conducted on the prime word prior to a response to the target (reviewed, e.g., Maxfield, 1997). This is known as the prime task effect. One explanation for this effect is known as the *activation-suppression account*, which states that semantic activation of the prime occurs automatically, but that behavioural facilitation (priming) is suppressed because the letter search task directs attention away from meaning, resulting in suppression of the semantic representation (Maxfield, 1997; Mari-Beffa et al., 2005). This suggests that semantic processing consists of an automatic stage and a subsequent task-dependent stage.

The purpose of the present study is to explore whether the activation-suppression account may also explain response time (RT) patterns in word recognition tasks that do not involve semantic priming. Specifically, we present data from three tasks that involved the presentation of a single (experimental/control) word, followed by different types of subsequent stimuli upon which the various decisions were made. In the letter detection task (Experiment 1), two letters appeared following an experimental/control item, and the participant decided which letter was present in the preceding item. In the shape judgment task (Experiment 2), two shapes of different sizes followed an experimental/control item, and the participant decided which shape was larger. Finally, in the implicit lexical decision task (Experiment 3), two 5-letter letter strings (one real word and one non-word) appeared following an experimental/control word,

and the participant decided which was the real word. The experimental words are uniform across tasks and vary with respect to concreteness (concrete versus abstract) and semantic neighbourhood density (SND; low versus high), which refers to the number and proximity of neighbouring concepts to a target word in memory (Durda & Buchanan, 2008). These variables have demonstrated semantic effects in separate bodies of literature (e.g., concreteness effects; Paivio, 1991 and SND effects; Buchanan, Westbury, & Burgess, 2001). Recently, concreteness and SND have also produced interactions in several tasks (Danguecan & Buchanan, 2014). Therefore, the present study sought to determine how recognition RTs of words varying in concreteness and SND are impacted by three tasks that require strategic control of attention.

Interestingly, the results of Experiments 1 and 3 revealed markedly slow RTs for the word condition that should have produced the fastest RTs (i.e., concrete-high SND words). RTs for the other conditions were relatively faster and minimally different from each other. Such a pattern of results is consistent with an extension of the activation-suppression account, whereby greater ease of automatic semantic processing is positively related to the degree of subsequent suppression required. Moreover, it appears that the activation-suppression account is only applicable to the processing of language symbols, as the shape judgment task (Experiment 2) produced no semantic effects. These data support the use of concreteness and SND as useful measures in the study of implicit semantic processing. Ultimately, these findings also demonstrate that a comprehensive model of semantics should also consider how attentional control is flexibly modulated by task demands.

Found in translation: Evidence from response times and eye-tracking shows that translated idioms are treated as formulaic units in L2

Gareth Carrol, Kathy Conklin, Henrik Gyllstad

The representation of lexical items in the bilingual lexicon has received a lot of attention. A consistent theme is that encountering a word in the second language (L2) should activate the equivalent form in the first language (L1) (de Groot & Nas, 1991; Wang, 2007). Some models (e.g. the Revised Hierarchical Model, Kroll & Stewart, 1994) suggest that this is because words in either language share a single conceptual representation. The current research combines two strands of investigation to explore the representation of idioms in the bilingual lexicon. That is, are multiword items that are idiomatic/formulaic in one language also treated as such in translated forms by bilingual speakers? So, if a French speaker reads the first few words of *howl with the wolves*, a translation of the French idiom *hurler avec les loups*, do we see facilitation in the same way as we do for native speaker idiom processing (activation of an underlying figurative concept and priming of all component words)? In a series of studies we investigated how proficient non-native speakers (with L1 Chinese and Swedish, respectively) process Chinese and Swedish idioms that were transliterated into English.

Evidence from a primed lexical decision task suggested that Chinese-English bilingual speakers responded more quickly to English words that would complete a translation of a Chinese idiom (e.g. *draw a snake and add… feet*) than control items (*draw a snake and add… hair*). English native speakers showed no difference for translated Chinese items. In a follow-up eye-tracking study, native Chinese speakers demonstrated significantly faster reading times for translated idioms vs. control items that were embedded in short contexts biasing the figurative meaning. We also compared sequences that could be used in both figurative and literal contexts, (e.g. the English phrase *at the end of the day*). English native speakers read English items equally quickly in the two contexts, but Chinese-English bilinguals showed a consistent advantage for literal phrases, both for English idioms and translated Chinese items. This suggests that while the form of idioms (the component words) was being facilitated across languages, the underlying figurative concept was not available to help sentence level decoding.

A further eye-tracking study of Swedish-English bilinguals adds two considerations. First, items were presented in minimal neutral contexts so that no preceding material was available to bias a figurative/idiomatic phrase. This enables us to determine whether the activation of known combinations is automatic even when there is no discourse-level reason to expect that a phrase will continue as an idiom. Second, three categories of idiom are included (all presented in English): English only idioms, translations of Swedish only idioms, and congruent idioms (that exist in both Swedish and English). In agreement with previous studies of cross-language formulaic language (e.g. Wolter & Gyllstad, 2011), congruency is seen to be an important factor, with those idioms that exist in both languages showing the shortest reading times. The lack of any supporting context did not seem to impair recognition of congruent or Swedish only items, suggesting that these lexical combinations are in some way represented in both L1 and L2.

We discuss the implications of all three sets of results for the organisation of the monolingual and bilingual lexicons, in particular how words are represented and linked between languages.

Effects of masked (pseudo)morpheme repetition priming using opaque and pseudo- compounds

Christina Gagné, Thomas Spalding, Kelly Nisbet, Caitrin Armstrong

There is no clear consensus about whether morphemic structure is explicitly represented in the mental lexicon (e.g., Roelofs & Baayen 2002; Giraudo & Grainger 2000; Sandra 1994) or whether it emerges from representations of form and meaning (e.g, Bybee 1995; Taft & Kougious 2004). There is also debate about whether decomposition (if it occurs) precedes or follows lexical access. The aim of the current project is to investigate whether the language system attempts to construct a meaning whenever potential morphemic representations are available, regardless of whether it is appropriate (see Gagné & Spalding 2009, 2010; Ji et al. 2011). Schreuder and Baayen (1995) found that response latencies and subjective frequency ratings of a monomorphemic word are influenced by the number of morphologically related forms for that word, which suggests that a morpheme actives morphologically related words. However, it is unclear whether similar effects occur when a morpheme is used non-productively, as is the case for pseudo-compounds; for example, *carpet* is monomorphemic yet can be divided into two letter strings that correspond to two free morphemes (*car* and *pet*). We also examined fully opaque compounds (e.g., *hog-wash*) because, although the meaning of the constituents do not contribute to the meaning of whole-word, opaque compounds have a morphemic structure. That is, fully opaque compounds and pseudo-compounds differ in morphemic structure but not in semantic transparency.

We investigate whether exposure to a pseudo-compound or fully-opaque compound affects the ease of processing an embedded word, as indexed by lexical decision times. In all experiments, a masked prime was presented prior to the target word. In Experiment 1, the prime was either a pseudo-compound (e.g., *carpet*) or frequency-matched control (e.g, *chair*) and the target was either the first (e.g., *car*) or second pseudo-constituent (e.g., *pet*) of the pseudo- compound. In Experiment 2, the target corresponded to the first pseudo-constituent (e.g., *spar*) and the prime was either a pseudo-compound (e.g., *sparrow*), an orthographically related word (e.g., *sparkler*), or frequency-matched unrelated word (e.g, *mutiny*). In Experiment 3, the target (e.g., *musk*) was preceded by either a fully opaque compound (e.g., *muskrat*), an orthographically related word (e.g., *musketeer*), or a frequency-matched control (e.g., *anagram*).

We found that the influence of presenting the word containing the embedded (pseudo)morpheme depended on the presence of a morphemic structure. It was more difficult to respond to a word that was briefly seen as a part of a pseudo-compound; responses were slower and less accurate when the masked prime was a pseudo-compound than when the prime was an unrelated word. In contrast, responses to the embedded morpheme were faster and more accurate when the masked prime was an opaque compound than when it was an unrelated word.

Our results indicate that the the language system parses incoming stimuli and attempts to construct a meaning whenever morphemes become available. The impact of this processing depends on whether the word actually has a morphemic structure. In the case of pseudo- compounds, the bi-morphemic structure conflicts with the monomorphemic nature of the word and this induces processing difficulty for the first (pseudo)constituent. In the case of opaque compounds, the bi-morphemic structure is not suppressed because opaque compounds do have such a structure even though the established meaning of an opaque compound is not semantically compositional.

Distance between Word Meanings Modulates the Neural Correlates of Semantic Ambiguity

Christopher M. Grindrod, Emily O. Garnett, Svetlana Malyutina, Dirk B. den Ouden

Recent research views the mental lexicon as a continuous space where all lexical dimensions are represented (Elman, 2004; Mirman et al., 2010). For example, distances between representations of word meanings are a function of semantic and syntactic similarity such that words with unrelated meanings from the same grammatical class (e.g., *palm*) are closer in semantic space than words with unrelated meanings from different grammatical classes (e.g., *swallow*). Psycholinguistic studies have shown that recognition of ambiguous words is influenced by the distance between meanings. Specifically, ambiguity at small semantic distances speeds word recognition whereas ambiguity at large distances slows word recognition (Mirman et al., 2010; Rodd et al., 2002). These findings argue that meanings that are closer in semantic space exhibit greater competition which in turn slows word recognition. Previous neuroimaging studies investigating the neural correlates of ambiguity have produced inconsistent findings, most likely because they did not control for effects of semantic distance (Chan et al., 2004; Hargreaves et al., 2011). Thus, while there is a behavioral cost in processing meanings that are close in semantic space, how this is reflected in the neural systems underlying ambiguity processing remains unanswered.

The goal of the present study was to investigate whether the neural correlates of ambiguity are modulated by semantic distance. In this event-related fMRI study, participants read ambiguous words that differed in terms of grammatical class (i.e., noun-noun (NN) vs. noun-verb (NV) homonyms) and meaning frequency (i.e., balanced homonyms with two equally frequent meanings vs. unbalanced homonyms with a highly dominant meaning), unambiguous words, and nonwords. Critical stimuli included balanced NN homonyms (e.g., *match-fire, match-game*), unbalanced NN homonyms (e.g., *toast-bread, toast-*speech), balanced NV homonyms (e.g., *rock-stone, rock-sway*), and unbalanced NV homonyms (e.g., *duck-bird, duck-avoid*). Participants were asked to make a lexical decision while their reaction time and accuracy were recorded in the scanner. We hypothesized that neural activation would be graded based on the distance between meanings in anterior and posterior brain regions, such as the inferior frontal gyrus (IFG), middle temporal gyrus (MTG) and superior temporal gyrus (STG), all of which have previously been implicated in the storage, retrieval and computation of word meaning.

Consistent with this prediction, balanced homonyms were associated with increased activation in bilateral MTG and STG, left superior frontal gyrus, and right anterior cingulate cortex, suggesting that two equally frequent meanings are simultaneously co-activated and compete to a greater extent than the meanings of unbalanced homonyms. In addition, NV homonyms were associated with increased activation in bilateral IFG, right hippocampus extending into the STG and MTG, and anterior cingulate cortex, arguing that processing homonyms with meanings from different grammatical classes requires additional resources because of increased competition between meanings that are close in semantic space. Taken together, the present findings argue that processing ambiguous words with multiple unrelated meanings places increased demands on the language processing system. They also provide evidence that activation of bilateral frontal and temporal regions is modulated by the extent to which alternative interpretations compete, which is consistent with previous studies of lexical and syntactic ambiguity resolution (Mason & Just, 2007; Rodd et al., 2010). Lastly, these findings suggest that frontal regions, in particular the IFG, may also be recruited when distinct lexical frames associated with noun and verb meanings must be retrieved.

Tracking the time course of the processing of reduced infinitives: An ERP study

Kimberley Mulder, Linda Drijvers, Mirjam Ernestus

In spontaneous speech, speakers often produce words in a reduced form, with fewer speech sounds. Examples of reduced pronunciation variants are the English words *s'pose* and *yeshay* for *suppose* and *yesterday*, respectively. Native listeners understand reduced pronunciation variants effortlessly. Nevertheless, recent behavioral studies show a processing advantage for the unreduced variants of words, especially when words occur in isolation (e.g., Ernestus and Baayen, 2007). The question is whether this processing advantage remains when words are presented in a more natural context, namely in sentential context.

We investigated this question in three ERP experiments. We compared the brain response to reduced and unreduced variants of words in three different contexts: in isolation (Experi-

ment 1), and in a full sentence at either sentence-final position (Experiment 2) or mid-sentence position (Experiment 3). In all experiments, native speakers of Dutch listened passively to 200 Dutch stimuli while their brain activity was recorded, and they made comprehension questions after blocks of stimuli. Target words were 80 prefixed infinitives such as *bedriegen* ('to betray') realized with or without a schwa in the prefix.

Schwa reduction was expected to affect the N400, an ERP component reflecting difficulty of lexical-semantic activation and integration within a given context. We expected that the processing advantage for unreduced variants in isolation, as observed in the behavioral literature, would translate into delayed N400s for reduced variants in Experiment 1.When the words are presented in sentences (Experiments 2 and 3), this advantage may be lost and no delay in the N400 may be expected.

In Experiment 1, the N400 occurred significantly later for reduced than for unreduced variants in isolation. This suggests that it takes more effort to activate the appropriate meaning in the lexicon when the word is reduced in a situation in which it is seldom reduced. We thus replicated the processing advantage for unreduced variants in isolation.

Experiment 2 showed large differences among participants. For most participants, the N400 peaked earlier for reduced than for unreduced variants. At sentence-final position, the occurrence of a prefixed infinitive may have been predictable, and therefore the reduction of the prefix may not have delayed the recognition process. In contrast, the reduction led to shorter words and therefore, if the word was reduced, participants could access the mental lexicon more quickly.

In Experiment 3, there was no significant difference in the position of the N400 peak between the sentences with unreduced and reduced variants. In mid-sentence position, the infinitive could not be predicted. Nevertheless, the reduction did not result in a significant delay because it occurred in a situation in which it is natural to occur.

In conclusion, the time course of the processing of a reduced variant depends strongly on whether the reduction occurs in a natural position and on the predictability of the word.

Representation and processing of duration contrasts: an MMN study

Sandra Kotzor, Allison Wetterlin, Adam Roberts, Aditi Lahiri

Durational cues are used in language to fulfil several different functions; a substantial number of languages use the contrast between short (singleton) and long (geminate) consonants to differentiate lexical meaning (e.g. Bengali [pata] 'leaf vs. [pat:a] 'location'). How these durational aspects are represented and how the representations, in turn, affect the processing of length contrasts has not yet been definitively established. Previous research shows that phoneme quality and quantity are processed independently of each other (cf. Ylinen et al. 2005), which has given support to theories proposing a separate level of representation for non-featural contrasts such as duration and tonal accent. To gain a better understanding of the nature of the representations of durational contrasts in the lexicon, and how these underlying differences may affect processing, we conducted a series of behavioural and EEG experiments in Bengali, a language with a productive medial geminate-singleton contrast.

Previous experiments - lexical decision tasks with fragment form priming and full-word semantic priming - showed an asymmetric pattern of results in both the behavioural and ERP (N400) data. A geminate nonword (*[ʃon:a]) is accepted for a real word singleton ([ʃona]) and elicits a significant priming effect as well as no enhanced N400 response, but a singleton nonword (*[gʰena]) does not result in facilitation of a target related to a geminate word ([gʰen:a]) and displays a significantly greater N400 amplitude.

A subsequent mismatch negativity (MMN) study investigated whether this asymmetry is also evident in pre-attentive auditory processing. Bengali word/nonword pairs which only differed in the duration of the medial consonant ([gʰen:a]/*[gʰena] and [kena]/*[ken:a]) were presented in a standard oddball paradigm (15% deviants). The results show a latency difference with the singleton nonword *[gʰena] being significantly slower than the real word geminate [gʰen:a] while [kena]/*[ken:a] peak at a similar latency. The asymmetry is thus already evident in pre-attentive processing despite the distance of deviance in the stimuli being identical (which is evidenced by the lack of amplitude difference between conditions). In the case of a nonword, where there is no readily available lexical representation, the MMN response is slower than when a lexical entry can be accessed. This is in line with previous evidence that the MMN also reflects higher cognitive processes and access of linguistic long-term memory traces (cf. Näätänen et al. 2001) and lends support to the theory that the singleton nonword *[gʰena] is treated as a nonword while the geminate nonword *[ken:a] elicits the same pattern as the corresponding real word [kena].

The overall findings provide greater insight into the processing of linguistic duration and how this is mapped onto a representation of length in the mental lexicon. Geminates are represented on the prosodic level by a length specification (e.g. mora) while singletons are not. A geminate mispronunciation subsumes the singleton real-word representation because all other (featural) information is identical. However, when a geminate is mispronounced as a singleton, the length specification necessary to match a geminate representation cannot be generated from the duration in the acoustic signal and activation fails. Thus, full lexical access is achieved through a mispronunciation only if there is sufficient duration in the acoustic signal to map onto the length specification of the corresponding real-word.

I scream for ice cream: Resolving Lexical Ambiguity with Sub-phonemic Cues

Yoonjeong Lee, Elsi Kaiser, Louis Goldstein

Lexical ambiguities arise with 'open juncture' sequences such as ice cream/I scream. Prior work on word recognition shows that listeners make efficient use of sub-phonemic/allophonic cues (e.g., McMurray, Tanenhaus & Aslin, 2009). However, most prior work on ambiguous open juncture sequences has investigated situations with clear prosodic boundary cues. Little is known about whether, in connected speech contexts without strong prosodic boundary cues, listeners can exploit local sub-phonemic cues such as voice onset time (VOT) to segment these ambiguous sequences. If there are two competing segmentation options, which do not differ in their syntactic or semantic plausibility, do sub-phonemic cues guide lexical ambiguity resolution?

We used a mouse-tracking paradigm to examine listeners' segmentation of English internal open juncture sequences embedding /s/-stop sequences (e.g., "*base pam*" vs. "*bay spam*", "*trace tab*" vs. "*tray stab*", "*place kin*" vs. "*play skin*"). These sequences differ in the degree of aspiration of the stop (Lehiste, 1960): The voiceless stop consonant in a cluster (e.g., /k/ in "*skin*") has a shorter VOT (less aspiration) than a word-initial voiceless stop consonant (e.g., /k/ in "*kin*"). We tested if listeners use these VOT cues to segment ambiguous sequences.

Elicitation phase: Four speakers produced the ambiguous /s/-stop sequences in carrier sentences which placed them in phrase-internal unaccented positions. Then, ambiguous sequences (e.g., "*place kin*" or "*play skin*") were extracted from the carrier sentences, and spliced as follows: VOTs for the stops in /s/#/C/ syllables ('place # kin') were replaced (i) by VOTs of another /s/#/C/ syllables (*identity-spliced*), (ii) by VOTs of #/

sC/ syllables (*cross-spliced*). VOTs for the stops in #/sC/ syllables ('play # skin') were replaced (i) by VOTs of another #/sC/ syllables (identity-spliced) or (ii) by VOTs of /s/#/C/ syllables (cross-spliced). (Before splicing, we analyzed the VOTs of voiceless stops in onset clusters and word-initially and confirmed that they pattern as expected.)

Main experiment: Participants (n=20) heard the two-word sequences (e.g., "*place kin*" or "*play skin*"), while looking at computer displays with the second word in the left/right corner (positions counterbalanced; e.g., "*KIN*" (intended target) and "*SKIN*" (competitor)). Semantic associations between words were minimized. The task was to click with the mouse on the second word that they heard. Click responses and mouse trajectories were recorded.

Results: Although mouse trajectories did not differ significantly, *click responses* show significant effects of VOT sensitivity: When asked to click on what they heard, listeners chose the intended target over the competitor significantly more in the identity-spliced condition than the cross-spliced condition—i.e., they were 'tempted' by the competitor in the cross-spliced condition. Thus, VOT cues can bias listeners' interpretation of the possible location of a word boundary between /s/ and the following stop, even when other cues in the acoustic signal (e.g., duration of /s/) point to the alternative segmentation.

As a whole, our study suggests that segmentation and lexical access are highly attuned to bottom-up phonetic cues; this kind of information may be stored as abstract knowledge in the listeners' lexicon (e.g., gestural representations, Browman & Goldstein, 1986).

The processing of polysemy and homonym on sentence integration : ERP evidence

Hye-In Jeong, Hongoak Yun, Upyong Hong

One of the controversial issues on the representation and processing of ambiguous words (e.g., homonyms, polysemy) is whether polysemy has separate representations by its senses, unlike the wide agreements that homonyms are separately represented in mental lexicons (Foraker & Murphy, 2012; Klein & Murphy, 2001; Klepousniotou et al., 2008). However, not many studies have attempted to compare directly the processing of polysemy to that of homonym (Brocher et al., 2012). Moreover, a number of existing studies on this issue have tested on English. We extended this issue into Korean. The goal of our study is to demonstrate that the processing of polysemy is different from that of homonym. In particular, we are testing our idea on sentence comprehension, by using the event-related potentials (ERPs).

Our idea lies on the assumption that while reading sentences, comprehenders expect upcoming words. If the contextual information is strongly constraining, the expectation for an upcoming word becomes specific. Thus, when a word that is congruent to the context appears, the integration of the word into the sentence will be facilitated. However, if an incongruent word occurs, the integration of the unexpected word will be a bur-

den. We hypothesize that the congruency effect will be bigger in the processing of homonym sentences than that of polysemy sentences. Also, the effect will be elicited more strongly when the dominant senses of ambiguous words are used than when the subdominant senses are used. To examine our hypotheses, we constructed our materials as they are shown in Table 1. The components corresponding to N400 and P600 effects were significantly taken into account in the processing of sentence-finally occurring verbs where the congruency effect is supposed to elicit. Note that our study is currently in progress and we report our results from the pilot study (data from 15 participants).

As displayed in Table 2, the congruency effect was observed differently by whether target words occurred in the homonym or polysemy context and in the dominant or subdominant context. We discuss our results in that the locust of processing difficulty that we observed is attributed to how strongly the contextual information is constraining as a function of whether the representation of ambiguous words are separated like homonymy or overlapped like polysemy.

Table 1. Examples (Underlined italics are ambiguous words and bolds are targets.)

Homonymy	Dominant	Congruent	kenchwukkaka pokcaphan *kwucolul*	cengmilhakey **selkyeyhayssta**
		Incongruent		takuphi **yochenghayssta**
	Subdominant	Congruent	phisekayki sinsokhan *kwucolul*	takuphi **yochenghayssta**
		Incongruent		cengmilhakey **selkyeyhayssta**
	Neutral	Congruent	kyengswuka cheykyeycekin *kwucolul*	cengmilhakey **selkyeyhayssta**
		Incongruent		takuphi **yochenghayssta**
Polysemy	Dominant	Congruent	sunimi sangkhwayhan *achimul*	himchakey **sicakhayssta**
		Incongruent		masisskey **mekessta**
	Subdominant	Congruent	apecika phwucimhan *achimul*	masisskey **mekessta**
		Incongruent		himchakey **sicakhayssta**
	Neutral	Congruent	yeycika ilun *achimul*	himchakey **sicakhayssta**
		Incongruent		masisskey **mekessta**

Table 2. Summary of ERP results

| | Homonym | | | Polysemy | | |
	Dominant	Subdominant	Neutral	Dominant	Subdominant	Neutral
N400	left central parietal	No	No	No	No	No
P600	central midline and left/right central-parietal	left/right central-parietal	No	Almost all areas	No	No

Neighborhood Effects in Wordlikeness Judgments of Nonlexical Mandarin Disyllables

James Myers

Previous work has shown that Mandarin native-speaker wordlikeness judgments of nonlexical syllables are influenced positively by lexical neighborhood density (Myers, 2009), just as they are for other languages like English (e.g., Bailey & Hahn, 2001). Although virtually all morphemes in Mandarin are monosyllabic, most Mandarin words are disyllabic (specifically, left-headed binary feet; Duanmu, 1999). The present experiment thus examined neighborhood effects in Mandarin judgments for nonlexical disyllables, using a speeded megastudy design to probe the time course of neighborhood influences on judgments.

Creation of the test items started by taking all 3,274 nonlexical syllables that can be written in Taiwan's Zhuyin Fuhao phonetic orthography, which transcribes syllables in terms of onset, prevocalic glide, rime, and tone. We then randomly selected 3,000 disyllables from all possible combinations of these nonlexical syllables. Neighborhood density was computed for each syllable by counting the number of lexical Mandarin syllables differing from the target syllable by exactly one consonant, glide or vowel (ignoring tone). Fifty-one native Mandarin speakers were presented with the disyllables in written Zhuyin Fuhao and asked to make speeded binary judgments on whether they were "like

Mandarin". To encourage participants to evaluate the entire stimulus while still responding quickly, they were given a series of practice sessions with progressively shorter deadlines.

Mixed-effects logistic regression analyses showed that neighborhood density for both syllables had significant positive effects on judgments, although significantly stronger for the first syllable. Moreover, the syllable neighborhood effects interacted with each other, with second syllable neighborhood density effects stronger when the first syllable neighborhood density was itself higher. Including response times as a predictor revealed a significant interaction with the first syllable neighborhood density, with this effect weakened in slower responses; there was no change in the second syllable neighborhood density effect over time.

Together the cross-syllable interactions and time course results suggest that Mandarin speakers judge the wordlikeness of disyllables sequentially, but in a partially integrated way, with judgments for the second syllable modulated by lexical properties of the first. This experiment not only reconfirms the role of disyllabic units in Mandarin, but also the dominance of the first syllable, despite the paucity of stress-based evidence for left-headed binary feet in this language.

The bilingual "hard problem" in spoken word production among Arabic-French bilinguals: A language-specific or nonspecific process?

Mariem Boukadi, Maximiliano A. Wilson

While there is general consensus in the literature on the presence of cross-language activation during bilingual word production, lexical selection remains a matter of debate. According to one view this competitive process is language-specific, while another holds that it is language- nonspecific. Thus far, studies supporting either view have yielded conflicting and inconclusive evidence. Most of them have focused on highly proficient

bilinguals whose languages were typologically close (e.g., Costa, Colomé, Gomez, & Sebastian-Gallés, 2003; Hoshino & Thierry, 2011). The aim of the present study was to investigate the lexical selection process among late moderately proficient bilinguals whose two languages are typologically distant: Tunisian Arabic (TA) and French.

Method

Participants. Two groups of TA-French bilinguals (in both groups, mean age: 27 years old; mean education: 19 years) took part in this study (n = 24 in each group). All were moderately proficient, according to Meara's (1992) ΔM (= 0.29) measured in a lexical decision task, and learned their L2 (French) around the age of nine.

Task. The picture-word interference task was used in two experiments. Participants were asked to name 22 pictures in their L2 while ignoring auditory distractors in their L2 (Experiment 1) or their L1, TA (Experiment 2). Four distractor types were presented: (1) semantic (i.e. semantically related to the picture), (2) phono-translation (i.e. phonologically related to the picture name in L1), (3) phonological (i.e. phonologically related to the picture name in L2), and (4) unrelated. Distractors were presented at three SOAs: (1) -150 ms, (2) 0 ms, and (3) +150 ms. Stimuli were matched by subjective frequency, imageability, and word length.

Data analysis. A mixed effects model (Baayen, Davidson, & Bates, 2008) was used with RTs as dependent variable, participants and items as random effects, and distractor type (1-4) and SOA (1-3) as fixed factors. Error rates were too low (Exp. 1 = 3.58% and Exp. 2 = 4.04%) to be submitted to analysis of variance. Comparisons of distractor conditions (1-3) with the unre-lated one (4) were also carried out to establish the interference or facilitation effect of distractors.

Results. In both experiments, distractor type and SOA significantly affected RTs (ps < .05). The interaction distractor x SOA did not reach significance. In Experiment 1, a facilitation effect in the phonological condition was found. No effects were observed in the other distractor conditions. SOA 2 was significantly slower than the other two. In Experiment 2, interference effects were found in the phono-translation and phonological conditions. However, the expected semantic effect was absent. SOA 1 was significantly faster than the other two.

Discussion. Results seem to indicate that there is cross-language activation among moderately proficient TA- French bilinguals in monolingual (Experiment 1) and bilingual (Experiment 2) contexts as indexed by the phonological effect. However, cross-language competition seems to occur only in a bilingual context (Experiment 2) as indexed by the phono-translation interference effect observed. Our findings are in line with the recent hypothesis that lexical selection is a dynamic process that can be language-specific or non-specific depending on several factors including (but not limited to) language proficiency and context.

Inflectional Paradigm in Second Language Lexical Access: Decomposition without Recomposition

Kira Gor, Anna Chrabaszcz, Svetlana Cook

Second language (L2) speakers have smaller mental lexicons than native speakers, which makes their reliance on whole-word storage and access of a great number of inflected words less likely. Indeed, there is behavioral evidence that L2 speakers decompose inflected words in lexical access. This evidence includes decomposition costs in a lexical decision task (LDT) (Portin et al., 2007, 2008), and facilitation effects in overt and masked priming (Basnight-Brown et al., 2007; Feldman et al., 2010; Gor & Jackson, 2013). However, there is conflicting evidence on the lack of L2 speakers' sensitivity to inflectional morphology both in lexical access of single words (Clahsen et al., 2010) and in morphosyntactic processing at the sentence level (Coughlin & Tremblay, 2013). The shallow structure hypothesis (Clahsen & Felser, 2006) explains this lack of L2 morphological sensitivity by L2 reliance on lexical meanings and whole-word access and storage. If L2 learners decompose words in lexical access, why do they not use the inflectional information?

Two auditory LDTs and a cross-modal priming experiment with L2 speakers differing in proficiency and native speakers of Russian targeting Russian nominal inflection have identified two reasons why L2 processing of inflected nouns may lead to morphosyntactic insensitivity. First, L2 speakers decompose an inflected word to access the entry in the mental lexicon via the stem, but they do not necessarily recompose and recheck it to process morphosyntactic information. In a LDT that compared the processing costs to overtly and zero-inflected nouns in the Nominative and Genitive cases (bumag-*a paper*$_{\text{NomFemSg}}$ – bumag-*ø paper*$_{\text{GenFemPl}}$ and zavod- *ø factory*$_{\text{NomMascSg}}$ – zavod-*a factory*$_{\text{GenMascSg}}$), both bumag-*ø* and zavod-*a* showed decomposition costs in L1. A different effect was observed in L2 speakers, who showed a false advantage in processing bumag-*ø* as fast as bumag-*a*, with no decomposition cost. Decomposition costs emerged in L2 higher-proficiency participants in the second auditory LDT where nonwords had real stems and inflections in illegal combinations, thereby drawing participants' attention to recomposition and rechecking. Second, L2 speakers are less efficient in their use of statistical probabilities related to the properties of the inflectional paradigm, in particular, case frequencies. In the auditory LDT, nonwords with the most frequent oblique case inflections took the longest time to be rejected by native speakers, but the shortest time by L2 speakers. In cross-modal priming with ambiguous case-inflected adjective primes (nov-*oj new*$_{\text{Gen/InstrFemSg}}$) and noun targets (mashin-*y* vs. mashin-*oj car*$_{\text{Gen}}$ or $_{\text{InstrFemSg}}$), L1 speakers responded faster to Genitive-inflected nouns, while this response bias emerged only in the highest-proficiency L2 group.

The behavioral results in the LDT with zero-inflected nouns in an oblique case with decomposition/recompostion costs incurred in L1, but not L2 echo the fMRI findings on Polish zero-inflected nouns that produced the same activation in the left fronto-temporal system as overtly inflected ones (Szlachta et al., 2012), while English simple monomorphemic nouns did not (Bozic et al., 2010). They are also in agreement with an fMRI study proposing that morphological decomposition costs have a late syntactico-semantic locus (Lehtonen et al., 2006). At the next step, the role of inflectional entropy, a measure of divergence of the probability of a case-inflected form of the particular noun and the probability of the case inflection for the whole class of nouns (Milin et al., 2009) in L2 lexical access should be evaluated. This will present a challenge given the smaller size of L2 mental lexicons.

The Mental Lexicon and Operations on Event Representations
David Townsend, Kendra McKim

Event interpretations depend on information in the mental lexicon and knowledge of the typical duration of events. We determined how verb semantics affects the processing costs of adding or subtracting the end-point of an event representation, and iterating an event (van Lambalgen & Hamm, 2005). We determined that adding an end-point increases eye fixation time and regressions, and that subtracting an end-point and iterating an event do not.

Addition, subtraction, and iteration are established by point, frequency and measure adverbs, and by verb semantics. Point adverbs (*last year*) specify the temporal location of a bounded event (1a). In order to contain an unbounded event (1b), addition adds an end-point.

1. a. *Sam climbed Mt Everest last year*.
   b. *Sam admired Mt Everest last year*.

Frequency adverbs (*every year*) specify the hiatus between instances of an event. With a bounded verb interpretation requires *iteration* to shift from one to multiple instances (2a). With an unbounded verb interpretation requires adding an end-point and then iterating (2b).

2. a. *Sam climbed Mt Everest every year*.
   b. *Sam admired Mt Everest every year*.

Measure adverbs (e.g., *for several minutes*) specify the duration of an unbounded event (3a). They shift the denotation of a bounded verb to a different type of event. In some cases, *subtraction* removes the culmination to create a homogenous activity (3b). In other cases, iteration shifts the interpretation from a single event to a series of events (3c).

3. a. *Sam admired Mt Everest for several minutes*.
   b. *Sam climbed Mt Everest for several minutes*.
   c. *Sam climbed Mt Everest for several years*.

Point, frequency, and measure adverbs allow us to determine the cost of addition, iteration, and subtraction. We measured eye movements as 48 participants read 24 sentences that varied in adverb type and verb type. For point and frequency adverbs, regressions from the adverb (e.g., *last year*) and total time in the predicate (e.g., *climbed a mountain*) were greater for unbounded verbs than for bounded verbs (all ps < .05 with the exception of item analysis of regressions from point adverbs), suggesting that addition increases processing difficulty. Within verb types, eye movement patterns were similar for point and frequency adverbs (all ps > .10), suggesting that iteration does not increase processing difficulty. For measure adverbs, eye movement patterns in the adverb and the predicate were unrelated to verb type (all ps > .10), suggesting that iteration/subtraction does not increase processing difficulty.

The data suggest that adding an end-point to an unbounded verb is more costly than subtracting an end-point from a bounded verb or iterating an event. The absence of a verb boundedness effect for measure adverbs suggests that aspectual interpretation may involve searching world knowledge to determine a plausible temporal distribution of an event (Deo & Pinango, 2011).

Poor and shallow: Semantic representations of hippocampal amnesic patients lack the richness and depth of healthy comparisons'
Nathaniel B. Klooster, Melissa C. Duff

Semantic memory is memory for word knowledge, language, and general information about the world and oneself (Tulving, 1972). According to the traditional view of semantic memory in cognitive neuroscience, the hippocampus is necessary to first acquire new semantic information, but over time, semantic representations are consolidated in the neocortex and become hippocampally independent (McClelland et al., 1995). Previously acquired semantic memory is considered fully intact and normal in hippocampal amnesia (Gabrieli, Cohen, & Corkin, 1988).

The methods used in neuroscience to examine semantic memory have been rather superficial, often including naming tasks or tasks requiring participants to match a label to a short definition. Other fields have taken a richer view of what it means to know a word or semantic fact, going beyond whether a participant knows the surface level meaning, to examine how much is known about concepts and how much information is associated with them. Here we borrow methods from these fields to reexamine the claim that in hippocampal amnesia, remote semantic memory is fully intact and normal, indistinguishable from healthy comparisons'. We tested 5 patients with bilateral hippocampal damage and severe declarative memory impairment and demographically matched, normal healthy comparison participants (NCs) on both productive and receptive measures of vocabulary depth and lexical richness.

The number of features of a concept (e.g. a *duck* has a beak, waddles, swims, quacks, lays eggs, has feathers, etc.) is an often-used measure of semantic richness in psycholinguistic studies (Pexman, Lupker, & Hino, 2002). We chose 60 words from normed databases (McRae, Cree, Seidenberg, & McNorgan 2005) and gave participants 2 minutes to list as many features for each word as possible. NCs listed significantly more features than amnesics.

The number of senses a word can take (e.g. *ace*: playing card; perfect tennis serve; fighter pilot) is another common psycholinguistic measure of semantic richness (Taler, Kousaie, & López Zunini 2013). We chose 60 words from normed databases (Nelson, McEvoy, Walling, & Wheeler, 1980) and gave participants 1 minute to list as many senses of each target word as possible. Again, amnesics produced significantly fewer senses than NCs.

The Word Associate Test (WAT) is a commonly used receptive measure of vocabulary depth in both first and second language-learning studies (Read, 1998). The test presents participants with 40 target adjectives and requires them to pick 4 correct associates or collocates from among 8 possibilities per target. Amnesic participants scored significantly worse than NCs on the WAT.

On both productive and receptive measures of vocabulary

depth and semantic richness, we find that a group of hippo-campal amnesic participants display impoverished remote semantic memory compared to demographically matched healthy participants. Future work will determine whether this deficit is an impairment in the access and use of the representations, a disruption in the representations themselves, or some combina-tion. Regardless, these findings suggest a reconsideration of the traditional view that remote semantic memory is fully normal following hippocampal damage. The hippocampus may continue to support the maintenance, updating, access, and use of semantic representations after their initial acquisition.

Dealers deal after corners corn? Semantic contribution to morphological analysis as revealed by incremental masked priming

Davide Crepaldi, Marco Marelli, Simona Amenta, Anais De Santis, Elena Angela Morone, Rocco De Marco

It is widely accepted that complex words such as "dealer" are decomposed into their constituent morphemes during visual word identification. This process seems to be unaffected by whether morphemes actually contribute to the word meaning – it would also break down "corner" into "corn" and "er". However, results from classic masked priming studies are not completely clear- cut (e.g., Davis and Rastle, 2011). Here we address this issue using incremental masked priming, which: (i) allows to track the temporal pattern of the effects by varying quasi-continuously the Stimulus Onset Asynchrony (SOA) between primes and targets within the same experiment; (ii) gets rid of unrelated primes by using the shortest-SOA condition as a baseline; (iii) retains the critical feature of classic masked priming, i.e., primes are kept outside participants' awareness, by using only sub-threshold SOAs (<60 ms).

In Experiment 1, 95 prime-target pairs of Italian words were devised in each of 3 conditions. In the first, genuine derived words primed their stems (*artista-ARTE, artist-ART*); in the second, pseudo-derived words primed their pseudo-stems (*retaggio-RETE, legacy-NET*); in the third, simple words primed orthographically related stems (*corallo-CORO, coral-CHOIR*). Prime- target pairs were tested in five different SOA conditions: 12ms, 24 ms, 35 ms, 47 ms, and 59 ms. Data on 208 participants show that: (i) genuine derivations and pseudo-derivations have similarly shaped priming trajectories across SOAs; (ii) when compared with each other, they are statistically equivalent in

size up to the 47-ms SOA; (iii) when compared individually to the orthographic baseline, pseudo-derivational priming emerges earlier than genuine derivational priming (35-ms SOA vs. 47-ms SOA).

Experiment 2 is a replication of Experiment 1 in a new sample of 141 participants. By using higher-frequency monitors, we were able to refine our "temporal resolution" and test seven different SOAs (8, 17, 25, 33, 42, 50, and 58 ms). Results were closely similar to those of Experiment 1 and revealed again similar priming trajectories across SOAs for *dealer-DEAL* and *corner-CORN*, equivalent priming for these pairs at all SOAs, and earlier significant priming for pseudo-derivations (SOA=25 ms) than for genuine derivations (SOA=33 ms).

Experiment 3 is a validation of the paradigm that was carried out using unrelated primes (and the same seven SOAs tested in Experiment 2). As expected, no consistent priming pattern was observed, thus confirming that data in Experiment 1 and 2 were driven by the nature of the relationship between primes and targets.

These data confirm that morphological facilitation is equivalent for genuine derivations and pseudo-derived words at the earliest steps in visual word identification. However, they also point to a more intricate interaction than what previously thought between form and semantics, as revealed by the surprising earlier effect with pseudo-derivations than with genuine derivations.

Phonological representation in the diglossic mental lexicon

Elinor Saiegh-Haddad

Introduction: Research has demonstrated that, in diglossic Arabic, the phonological distance between Standard Arabic (StA) and Spoken Arabic (SpA) affects children's ability to operate on the phonological structure of StA words, both in productive phonological awareness tasks as well as in recognition tasks. This effect was argued to be attributed to children's difficulty in constructing high-quality phonological representations for StA lexical items hence affecting phonological awareness.

The current study: The current study studied children's phonological representations in Arabic diglossia.

Method: We targeted three types of Arabic: a) *Identical words*, i.e. words that have an identical surface phonological form in StA and SpA; b) *Cognate words*, i.e. words that have an overlapping phonological forms in StA and SpA; c) *Unique words*, i.e., words that have a completely different lexico-phonological form in StA and SpA. We also systematically compered 4 types

of Cognate Words that varied in the type of distance. Task: We used a task similar to lexical decision (accuracy) to measure quality of phonological representation where half of the words were presented in their intact form and where the other half has undergone a systematic phonological alteration to construct a pseudo word. The word/pseudoword was presented orally and combined with a line drawing illustrating the object it referred. The child was required to decide whether the pronunciation of the target word was correct or not. If not, s/he was asked to provide the correct pronunciation.

Participants: A total of 120 Arabic native speaking children were tested in four age- grade levels: kindergarten, 1st grade, 2nd grade, 6th grade).

Results: The results revealed a main effect of grade as well as a main effect of type of word, with older children performing better than younger ones and with identical words demonstrat-

ing the most accurate phonological representations and yielding hence the highest accuracy scores. These were followed significantly by the Cognate and then by the Unique words. Within the Cognate words we found an effect of type of distance with some cognate words demonstrating poorer phonological representations than others depending on the type of distance they reveal between their phonological form in Spoken and Standard Arabic.

Conclusion: The results underscore the role of diglossia in developing high-quality phonological representation and the complexity of the diglossic mental lexicon of Arabic.

Emotional Targets Are Suppressed From Awareness Before Practice: Evidence From The Attentional Blink Task

Naveed Sheikh, Debra Titone

Goal-irrelevant attention-grabbing emotional information leads a double life: It can be suppressed from awareness according to emotion regulation accounts, but is boosted into awareness according to attentional accounts. We investigated whether this discrepancy can be reconciled by assessing whether awareness of emotionally charged words like *torture* is suppressed when a goal is unpracticed, but enhanced when a goal is well-practiced. We also examined whether executive control is related to the release of emotional suppression.

We addressed this question using a dual-target variant of the attentional blink (AB) task (Raymond, Shapiro, & Arnell, 1992). Participants reported the identity of a first target (T1) word and a second target (T2) word, which were presented in a rapid serial visual presentation (RSVP) stream of distractor words. A key variable is the lag (i.e., the positional difference in the RSVP) between the targets. The standard prediction for this task, given the existing literature, is that conscious awareness of T2, as indexed by report accuracy, should be impaired when it closely follows T1 in time, which is called an attentional blink (AB).

The task was administered to 24 native English speakers. We manipulated the emotionality of the targets: T1 was always a neutral word, and T2 was a negative, neutral, or positive word. The lag between the targets was either close (lag 2) or far (lag 7). We operationally defined practice through a systematic exami-

nation of practice effects across trials. Individual differences in executive control were measured with the Simon task after the AB task.

Generalized linear mixed models were fit to the accuracy data. We tested the interaction between emotional valence (negative vs. neutral vs. positive), lag (2 vs. 7), and trial number. We included random intercepts for subject, T1, and T2, and by-subject random slopes for valence and lag, and the slope-intercept interactions.

T2 accuracy was lower at lag 2 for negative and positive words compared to neutral words when the task was unpracticed, but was higher for emotional words when the task was well-practiced. We ruled out a fatigue-based account of this effect, and show that advantages for emotional targets following practice are larger for participants who have better executive control, and unchanged as a function of executive control for emotionally neutral targets.

Thus, we replicate previous reports of an attenuated AB for emotional targets (e.g., Anderson, 2005). However, we extend previous work by demonstrating that awareness of emotion is strategically suppressed when a task is unpracticed, but enhanced when the task becomes less vulnerable to interference following practice for participants with better executive control.

The mechanisms of prediction (pre-activation) of words in sentence processing — an ERP study

Jakub Szewczyk

In the recent years the role of prediction in language processing has been much appreciated. Many ERP studies demonstrated activation of predictable words before their actual presentation as a part of a sentence. In the present study we investigated the mechanisms leading to the preactivation of predictable words. To this aim, participants were presented with short stories:

During a school trip to the mountains, Peter was bragging about his good sense of direction. Even when he was not able to see the location of the sun, he was always able to point to the north. However, after two days, it was discovered that he was cheating. [E / NE] *Somebody noticed that he had hidden a compass* [C] / *a roof* [IC] *up in his sleeve.*

All the stories were presented on the screen all-at-once, except for the final sentence, which was presented word-by-word. In half of the stories, just before the story-final sentence (marked by [E / NE] above), explicit information was introduced, telling the participants that in the following sentence a specific target word will appear (Expectancy condition [E]). In the other half

of items, no information concerning the target word was given (No Expectancy condition [NE]). The target word was always the direct object of the main clause of the story-final sentence. In addition to the priming manipulation, congruity of the target word was manipulated: in half of the items, the target word was semantically congruent with the preceding context (congruent condition [C]), while in the other half it was not (incongruent condition [IC]). Priming and congruity manipulations were fully crossed.

NE-IC target words led to a standard N400+P600 effect, relative to target nouns in the congruent conditions (NE-C and E-C). Critically, incongruent target nouns preceded by expectancy inducing information (E-IC condition) did not evoke any N400 effect (and led to ERPs as positive as for nouns in the E-C condition).

In order to find the reason why expectancy led to the complete obliteration of the N400 effect at incongruent target words (E-IC condition), we analyzed ERPs elicited by the words of the story- final sentence preceding the target word presentation

(hereafter called intervening words). At the main verb (directly preceding the target noun), ERPs in the E-IC condition revealed a large centro-parietal negativity in the 400-800ms time-window, whereas ERPs in the E-C condition showed a centro-parietal positivity (relative to NE-C and NE-IC conditions). All intervening words preceding the main verb led to central or fronto-central negativities both for E-C and E-IC conditions, relative to NE-C and NE-IC conditions. ERPs time-locked to the expectancy inducing information led to a weak N400 in the E-IC, relative to the E-C condition.

These results show that the reason for the obliteration of the N400 effect at the target noun in the E-IC condition was that the incongruent target word had already been accessed and activated prior to its presentation as a part of the story final sentence. The preactivation of the noun occurred primarily at the main verb via a process similar to the process occurring when a word is actually presented (both of which are reflected by N400-like negativities). The results also show that in the no-expectancy conditions (i.e. in natural reading of the sentences, without any artificial expectation) participants pre-activated the congruent target words at the main verb.

The Activation of Lexical Information by Briefly Presented Action Scenes

Jens Bölte, Pienie Zwitserlood, Reinhild Glanemann, Claudine Meier, Christian Dobel

Visually presented objects or scenes are major parts of spoken word production paradigms. We investigated how rapidly visually presented action scenes, serving as primes, activate semantic and lexical information. In Experiment 1, action-scene targets were preceded by identical, same-action (but different actors), and unrelated action primes presented for 50 ms, 100 ms, or 150 ms. Primes were backward masked. Even the shortest presentation duration resulted in significant facilitation relative to the unrelated condition. A neutral baseline consisting of uninformative picture fragments was added in Experiment 2. Relative to this baseline, unrelated primes resulted inhibition while identical and same- action primes resulted in facilitation. In Experiment 3, verbs were used as targets instead of action scenes. Again, "identical" prime-target pairs were responded to fastest. Phonologically related but otherwise unrelated pairs caused inhibition relative to the baseline condition.

In sum, briefly flashed action scenes provide detailed sematic and even word-form information such that target naming is affected. The data corroborate earlier results that showed how little information is needed for object or scene categorization. They extend these findings by showing that lexical information is activated in a fast and automatic manner.

Frequencies of Different Grammatical Features and Inflectional Affixes in Russian Nouns: A Database

Natalia Slioussar, Maria Samojlova

Most researchers working with linguistic data sooner or later have to appeal to frequency. In many cases, an *ad hoc* comparison can be done: e.g. we can find out whether Dative is less frequent than Prepositional using one of the existing Russian corpora. However, creating a systematic database where frequencies of different grammatical characteristics are estimated on one corpus sample is a better solution. This way, we can see from the very start how the contrast we are interested in depends on other grammatical properties.

We present a database of Russian nouns created on the basis of the grammatically disambiguated subcorpus of the Russian National Corpus (http://www.slioussar.ru/freqdatabase.html).

We analyzed the frequency of different grammatical features in the following categories: gender, number, case, animacy (by themselves and in various combinations), looked at these categories in different declensions, and also at the distribution of different inflectional affixes. Such data are crucial for many theoretical and experimental approaches, especially for usage-based ones (e.g. Baayen 2003; Bybee 2006; Dressler 1985; Milin et al. 2009; Moscoso del Prado Martín et al. 2004). They may be useful not only per se, but also in solving auxiliary problems: for linguists, psychologists and other cognitive scientists choosing linguistic stimuli for their experiments.

Let us come back to the example of comparing Dative and

	Animate	Inanimate	Sum	Animate	Inanimate	Sum
Dat	24.326	51.399	75.725	6,3%	4,4%	4,9%
Prep	4.377	148.038	152.415	1,1%	12,8%	9,9%

Table 1. Frequencies of different cases depending and not depending on animacy.

		Animate	Inanimate	Sum		Animate	Inanimate	Sum
Dat	Sg	4,9%	3,4%	3,8%	Pl	1,4%	1,1%	1,2%
Prep	Sg	0,8%	10,4%	8,0%	Pl	0,4%	2,4%	1,9%

Table 2. Frequencies of different cases depending on number.

Nom.Sg	Dat.Sg	Acc.Sg	Prep.Sg	Nom.Pl	Nom.Sg	Dat.Sg	Acc.Sg	Prep.Sg	Nom.Pl
15,3%	9,7%	13,4%	61,1%	0,4%	6,2%	26,2%	8,8%	81,4%	0,8%

Table 3. The distribution of affix *-e*.   Table 4. The percentage of forms having affix *-e*.

The 9th International Conference on the Mental Lexicon

Prepositional to illustrate the advantages of such database. As Tables 1 and 2 show, in general Prepositional case is twice as frequent as Dative, but their relation is more complex if animacy and/or number are taken into account. In particular, Dative is more frequent than Prepositional in animate nouns, especially in Singular. Now suppose we are interested in morphological ambiguity and case syncretism – a hot topic in many recent morphological and psycholinguistic studies. Dative and Prepositional have the same affix -e in the 2nd declension. But is the distribution of nouns between these cases in this declension similar to the overall distribution of nouns between these cases? The database shows that it is very close. We may also want to take the following fact into account. Affix -e is used in Dative Singular only in the 2nd declension, while Prepositional

Singular also has it in the 1st declension. The overall distribution of this affix between different cases and numbers is shown in Table 3. We can also see how characteristic a given affix is for a given slot in the paradigm – Table 4 gives the relevant information for affix -e (it can also be extracted depending on gender etc.). As we hope to show with this example, the greatest advantage of the database is that it not only provides the researcher with various data, but may also offer some new lines of thought to pursue and hint at new factors to consider.

To test whether the database is suitable for psycholinguistic experiments, we conducted a lexical decision study (26 native Russian participants, *PsyScope* software), showing how various characteristics of noun stimuli affect RTs exactly as predicated by the database.

Imageability Asymmetry in Mental Lexicon of Croatian Aphasic and Healthy Speakers
Anita Peti-Stantic, Jana Willer-Gold, Vlasta Erdeljac

Imageability has been argued to induce asymmetry in processing of nominal lexical units as this feature of the mental lexicon unit is sensitive to the stimulus modality and to the conceptual system. Double modality of the representation of concrete nouns in the mental lexicon, verbal and non-verbal representation, contrasted with single, verbal, representation in abstract nouns [Paivio] is argued to facilitate the processing of a concrete noun and slow down successful retrieval, access and any further processing of an abstract noun [Sabsevitz et al.]. However, research confirming double dissociation of imageability underlines the claim that for the account of imageability it is equally crucial to verify the processing capacity of the mental lexicon's interface with the conceptual system [Gvion & Friedmann].

The first aim of the study is to investigate whether is a significant difference in the semantic processing of high and low imageable words in people with aphasia compared to the healthy control speakers when presented with a visual or auditive stimulus. The second aim of the study is to investigate whether the greater asymmetry in semantic processing of high and low imageable words stems from the incoming stimulus modality that is impaired in aphasic people, or to the interface processing capacity of the mental lexicon with the conceptual system.

Research was conducted based on the three tests designed to

examine the processing of the lexical feature of imageability: *Auditory Synonym Judgements*, *Written Synonym Judgements* and *Word Semantic Association* from the battery of tests PALPA adapted for Croatian [Kay et al., Erdeljac et al.] . To reduce the effect of perceptive impairments, general semantic processing was verified by conducting two follow-up PALPA comprehension tests: *Spoken Word-Picture Matching* and *Written Word-Picture Matching*. The study included 30 participants with different type of aphasia (motor, sensory, and global) and 30 paired healthy participants; all native speakers of Croatian.

In line with the predictions, there was a statistically significant difference between experimental and control group; the experimental group further confirmed the predictions by achieving significantly lower results with respect to low-imageable words. Difficulties in recognition of low imageable words in aphasics confirm the existing variations in the organization of processing pathways as imagined by Modular Models depicted in PALPA. These variations also correlate with the interaction of stimulus modality and facilitating effects due to representation modality as predicted by Dual-Coding Theory. Double- dissociation with respect to mental lexicon's interface to conceptual system is further discussed based on the results of the two comprehension tests.

Lexical representations of nouns in German rely on underspecified gender features
Thomas Pechmann, Andreas Opitz

Traditionally, instances of a certain grammatical category (e.g., gender or case) are categorically labeled to differentiate between distinct classes (e.g., masculine, feminine, neuter referring to gender in German). Current morphological theories, however, propose more fine-grained analyses of these categories with regard to their functional and structural characteristics. Inflectional markers that represent (or realize) one of those categories may either clearly correspond to one particular syntactic context, or refer to more than one syntactic context, i.e., an inflectional paradigm may exhibit instances of syncretism. This phenomenon is accounted for by abstract feature decom-

position and the concept of underspecification in almost all current morphological frameworks. The over-all idea behind these two concepts is a decomposition of 'traditional' labels of morphosyntactic categories into more abstract, binary features, thereby yielding the possibility to refer to natural classes of such categories. Thus, the three instances of grammatical gender in German could be described by two abstract binary features [±f] and [±m]: 'feminine' [+f, -m], 'masculine' [-f, +m], 'neuter' [-f, -m]. Interestingly, in all recent accounts of German inflection (Blevins, 1995, see also Opitz et al., 2013) which make use of feature decomposition and underspecification no reference

to any [-m] feature value is necessary to derive the system. As a consequence, one may ask if such a feature value [-m] that is never used for morphosyntactic operations is represented in the system at all. Thus, the basic question of our study was whether lexical representations of inherent features, i.e. gender information of nouns, are fully specified or rather underspecified.

The question whether morphological processing relies on more traditional or more fine-grained, abstract categories has been barely addressed in psycholinguistic research yet. Although there is first evidence that underspecification and feature-decomposition are involved in human language processing (see Clahsen et al., 2001, for behavioral studies, and Opitz et al., 2013, for ERP evidence) all of the studies so far addressed the processing of inflectional morphology (affixation and stem alternations). In contrast, the lexical representation of uninflected stems is regarded as fully specified with respect to inherent features. Lexical gender specification of German nouns may thus be labeled 'feminine', 'masculine', 'neuter' or [+f, -m], [-f, +m], [-f, -m], respectively.

Our findings from a series of experiments, however, challenge this view. We obtained results indicating that the processing of nouns in German, although matched for length, frequency, and morphological complexity, differs systematically between grammatical genders. In both lexical decision and gender decision tasks masculine bare nouns yielded longer latencies than feminine nouns which are of approximately equal frequency in German. These findings are interpreted as reflecting differently specific lexical representations of gender features for German nouns, i.e. feature sets that differ in their amount of informational content. They suggest that the observed processing differences are due to this variation in lexical representation compatible with modern morphosyntactic theories that go without any feature [-m]: two features for masculine nouns [+m, -f], as opposed to one feature for feminine [+f] and neuter [-f] nouns.

Lexical Access in Sign Language: A Computational Model

Naomi Caselli, Ariel Cohen-Goldberg

Theories of lexical access have predominantly been built upon data from spoken language, which leaves open the question: How many of the conclusions truly reflect language-general principles as opposed to modality-specific ones? There are a number of ways the language processing architecture could be organized with respect to facts about the signed and spoken modalities. At one extreme, it's possible that because signed and spoken languages are perceived through different channels (auditory versus visual), they utilize different cognitive mechanisms for all but the most central (i.e., semantic) stages of processing. It is also reasonable that signed and spoken word recognition utilize similar cognitive mechanisms to access sub-lexical and lexical elements, with only the specific content differing across modalities (e.g., manual sign location vs. oral place of articulation).

Whereas neighbourhood density effects differ by task in spoken language (e.g., inhibitory in speech perception, facilitatory in speech production), the effect of neighbourhood density in sign language depends on the types of signs considered. When a target sign has many neighbors that share the same handshape, recognition is facilitated; when a sign has many neighbors that share the same location, recognition is inhibited (e.g., Carreiras, Gutiérrez-Sigut, Baquero & Corina, 2008). One interpretation of this is that lexical access is modality-specific as there are no correlates to location and handshape in spoken language.

Using a computational model, we explore the possibility that differences in sign and word recognition are in fact superficial and that a common mechanism underlies lexical access in both modalities. Chen and Mirman (2012) presented a computational model of word processing that unified opposite effects of neighborhood density in speech production, perception, and written word recognition. We present a spreading activation architecture that borrows the principles proposed by Chen and Mirman (2012), and show that if this architecture is elaborated to incorporate relatively minor facts about either 1) the time course of sign perception or 2) the frequency of sub-lexical units in sign languages, it produces data that match the experimental findings from sign languages. This work serves as a proof of concept that a single cognitive architecture could underlie both sign and word recognition.

Mass counts in the World Wide Web: A corpus linguistic study of noun countability in world Englishes

Daniel Schmidtke, Paweł Mandera

This research used a corpus of global Internet English to explore the variation in the pluralisation of mass nouns (e.g. *luggages, violences*, and *advices*) across varieties of English. The countable use of mass nouns is a lexico-grammatical phenomenon that is hailed as a discernible proxy of the dividing line between native and non-native varieties of English (McArthur, 2002; Mesthrie and Bhatt, 2008). A recent study (Hall, Schmidtke & Vickers, 2013) confirmed this, using Google searches of the World Wide Web as a corpus linguistic tool. They revealed a significantly higher concentration of countable usage of 25 mass nouns among non-native L2 English users, compared to native L1 users of British English. In the current study, we employed a less restricted data-driven methodology, with which we were able to probe the extent of 'mass noun' countability across an expansive list of nouns, and among a greater variety of Englishes.

We queried Davies' (2013) 1.9 billion-word corpus of Global web-based English (GloWbE), for the raw frequencies of 17,757 singular noun lemmas and their plural counterparts. GloWbE represents 20 samples of English from 7 native-English speaking, 'Inner Circle' countries (e.g. Canada, Britain and Australia) and 13 'Outer Circle' countries (e.g. India, Hong Kong and Tanzania). We identified nouns that occurred significantly more frequently in plural form in the Outer Circle compared to the

Inner Circle, irrespective of the atomic (countable/mass) quality of each noun's referent. Once these nouns were isolated, we explored the underlying semantic and morpho-syntactic causes of the dissimilarity in countability preferences across Inner and Outer Circle Englishes.

Firstly, we found a significant convergence of the nouns used more countably in the Outer Circle with nouns that are routinely cited in the literature as grammatically 'mass'. This list represents a widespread countable usage of mass nouns, such as *equipments, softwares* and *slangs*. These nouns were also part of Hall et al.'s (2013) pre-defined mass noun word-list. Secondly, we observed a large number of previously unattested cases of pluralisation of mass nouns, more commonly in the Outer than in the Inner Circle.

In order to examine the semantic space of the nouns more frequently counted in the Outer Circle, we performed K-means clustering on Latent Semantic Analysis scores (Landauer and Dumais, 1997), a computational method of calculating semantic distances between words. The clustering technique produced a set of distinct categories that reflect the contexts in which pluralisation of 'mass nouns' is more prevalent. These categories included crime (*abductions, collaterals, evidences, extortions, followings* and *jewelries*), legalese (*abuses, adjournments, deliberations, discriminations, harassments, intimidations, litigations, malpractices, misconducts*, and *pleadings*), the lexicon of medical terminology (*consultations, inflammations, potencies, researches, serums* and *sicknesses*) and the abstract terms used in academic and literary scholarship (*additives, dualities, desperations, enjoyments, feminisms, greeds, logics, polemics, modernisms, miseries, sufferings, symbolisms, terminologies*).

Taken together, our results provide further confirmation of the heterogeneity of noun countability behaviour across the Inner Circle and Outer Circle varieties of English. We report an original finding that suggests that nouns that are more frequently pluralised in Outer Circle Englishes inhabit a circumscribed semantic space. Our method was blind to the theoretically grounded grammatical count/mass distinction, and, given the pattern of our results, we propose that the fixed binary distinction of count vs. mass is not an essential component in a theory of English language structure. Instead, it is a phenomenon best viewed as a gradient that is semantically and regionally dependent.

Morphologically complex words in working memory

Elisabet Service, Sini Maury

Most psycholinguistic work on morphologically complex forms has employed reading or visual lexical decision paradigms to investigate to what extent forms are decomposed during processing. We explored in two types of recall tasks whether inflected (e.g. boy+s) and derived (e.g. boy+hood) forms impose an extra load on working memory as compared to monomorphemic forms. Immediate serial recall of word lists is usually thought to reflect the capacity of phonologically coded short-term memory. This was compared to a complex span task: sentence span. In this task sentences have to be processed one by one. After each sentence, a memory word has to be added to a list that is recalled after the full set of sentences has been presented. Sentence span is generally assumed to require more controlled attention (general working memory) resources and to rely more on secondary memory than simple immediate recall.

The study was carried out in Finnish, a language with rich morphology. Previous work in Finnish has suggested that inflected forms are decomposed in both word recognition and production whereas derived words may be recognized as wholes even if they are assembled in production (Niemi, Laine, & Tuominen, 1994). We hypothesized that processing of morphologically complex forms in memory tasks would result in poorer recall performance if representing multiple forms at the same time resulted in competition at the morpheme level as well as the word level. We further assumed that effects in simple immediate recall would be more sensitive to form-based competition reflected in intra-list confusions. Performance in sentence span tasks would rely more on secondary memory and show greater semantic and lexical influences (Unsworth & Engle, 2007). Furthermore, we hypothesized that it would be easier to remember inflected forms incorporated into the sentences as their last words than to remember them as independent words after the sentence. The first experiment showed superior recall for the uninflected dictionary forms of words, also derivations, compared to inflected forms in immediate serial recall. The second and third experiments showed that both derived and inflected forms were recalled less well than monomorphemic forms in sentence span tasks. Sentence context appeared to support inflected forms. The fourth experiment included both immediate recall and sentence span tasks. Monomorphemic words were better recalled than derived words, which were better recalled than inflected forms. An error analysis revealed that intra-list confusions dominated immediate recall. In sentence span, extra-list errors were common, especially when inflected or derived words had been presented as separate words from the sentences that had to be processed.

We conclude that competition at morpheme level, especially between inflectional affixes, happens when several forms have to be activated at the same time with no syntactic support, as in immediate serial recall. In sentence span tasks, which rely more on abstract representations in the mental lexicon, such competition is extended to extra-list affixes for both inflected and derived forms.

Platform Session 3.2

11.00—11.20

Lexical processing masks speaker and writer detail

Chandan Narayan, Molly Babel, Michael McAuliffe

11.20—11.40

Testing the Orthographic Depth Hypothesis in a Brahmi-derived Writing System

Anurag Rimzhim, Carol Fowler, Leonard Katz

11.40—12:00

Hebrew Adjectives at the Interface of Morphology and Register

Dorit Ravid, Odelia Duani, Amalia Bar On, Ronit Levie

Lexical processing masks speaker and writer detail
Chandan Narayan, Molly Babel, Michael McAuliffe

In a series of experiments we examine whether linguistically meaningful units inhibits attention to indexical details of the signal. In Experiments 1 and 2, listeners were presented with two-word sequences which either do or do not form lexically meaningful compounds (e.g., base-ball vs. base-worm) in either same or different voices. Listeners were either asked to make a same or different talker decision (Experiments 1a and 2a) or a decision as to whether the word sequences formed compounds or not (Experiments 1b and 2b). Experiment 1 used a 500ms ISI designed to engage lexical processing while Experiment 2 used a 100 ms ISI designed to engage lower level, acoustic processing. When engaged in lexical processing, participants who were asked to make a talker decision exhibited interference from the compound status of the word, but those who attended to the compound status showed no interference from talker identity; Experiment 2 showed no interactions. These results suggest that chunking the speech signal into compounds interrupted the processing of low-level detail, while the talker variability had no effect on lexical processing. To assess how domain-general this phenomenon is, we conducted a parallel experiment exploring handwriting perception, which showed that lexical compound status affects writer identity decisions, while writer identity did not influence lexical decisions. Together, the results support interactive models of language processing (such as Grossberg's ART) where lexical information interacts with indexical processing.

Testing the Orthographic Depth Hypothesis in a Brahmi-derived Writing System
Anurag Rimzhim, Carol Fowler, Leonard Katz

Many cross-language studies have revealed both universal and orthography-specific aspects of skilled reading (Frost, 2012). For example, the study of skilled reading in almost all writing systems shows an effect of word frequency in both lexical decision and naming tasks; however, the frequency effect is modulated by the consistency of the mapping between the orthography and the phonology it represents. The complexity of the mapping (the "orthographic depth", Liberman, Liberman, Mattingly & Shankweiler, 1980), varies across orthographies. The influential *orthographic depth hypothesis* (Katz & Frost, 1992) is that readers of a deep orthography rely more on lexical than sub-lexical processing in naming than readers of a shallow orthography. This implies a relatively small difference in the sizes of the frequency effect in the lexical decision and naming tasks when the orthography is deep rather than shallow. In a deep orthography, the inconsistency of the orthography-phonology mapping tends to require lexical access for accurate naming; lexical decision always requires lexical access. In a shallow orthography accurate naming depends only on use of the orthography-phonology mapping without the necessity of lexical access. In the present study, we test the orthographic depth hypothesis in skilled reading of Hindī, a Brāhmī-derived orthography used for South and Southeast Asian languages.

Hindi has some unique orthographic features (Rimzhim, Katz

& Fowler, 2013) and has not been studied very much by psycholinguists. Therefore, it provides a good orthography for evaluating the orthographic depth hypothesis further. Hindi has a shallow orthography in that there is substantial consistency in the mapping between letters and phonemes. However, there is less consistency between akshars, another level of orthographic structure, and syllables. According to the orthographic depth hypothesis, if the orthography is functionally shallow (because readers focus on the level of letters where there is considerable consistency rather than *akshars*), there should be a smaller effect of frequency in naming than in lexical decision. We ran naming and lexical decision tasks with native speakers/readers of Hindī. In both tests, participants saw 208 high-frequency and 208 low-frequency words. In the lexical decision task, participants saw an additional 416 control nonwords. Preliminary analysis of participants' reaction times for all correctly pronounced items in the naming task and accurately identified words in the lexical decision task show that frequency has a highly significant effect for lexical decision ($p < .001$; $\eta p^2 = .59$) as well as naming ($p < .001$; $\eta p^2 = .40$), but there is no difference in the effect across the tasks ($p > .05$). These findings so far are not expected if readers focus on the letter-phoneme mapping; however, naming data are from a limited sample of the full data set and the size of the frequency effect is numerically greater by 17 ms for lexical decision than naming. We plan to finish coding naming responses and to present the full set of findings. Our results will reveal how similar or different is reading in Hindī from other writing systems.

Hebrew Adjectives at the Interface of Morphology and Register
Dorit Ravid, Odelia Duani, Amalia Bar On, Ronit Levie

Morphological structure and meaning are key in building lexical representations (Jarmulowicz & Taran, 2013; Wagovich, Pak & Miller, 2012), especially in a highly synthetic language such as Hebrew (Berman, 1995; Ravid, 2012). As lexicons expand in breadth and depth across children's development, their morphological composition changes as well (Anglin, 1993; Carlisle, 2010). At the same time, knowledge of a word's meaning as a distinct lexical entity goes far beyond its morphological components (Baayen, in press; Geeraerts, 2010). This tension between morphological and lexical classification is the topic of the current study, which concerns the adjective category in Hebrew. While Hebrew content-words are largely defined by their category- specific morphological forms, adjectives are the least well-demarcated category, sharing structures with both verbs and nouns (Ravid & Levie, 2010). For example, mesukan 'dangerous' is based on the present-tense *Pu'al* verb pattern *meCuCaC*, while *ta'im* 'tasty' shares the nominal pattern *CaCiC* with nouns such as *pakid* 'clerk'.

Our main research question was to what extent adjective morphology is related to linguistic register - characterized by Ferguson (1994:16) as "the linguistic differences that correlate with different occasions of use" and elaborated for Hebrew as "levels of linguistic usage" related to semantic complexity, lexical specificity and degree of abstractness (Ravid & Berman, 2009: 111). We hypothesized that high-register adjectives would be more morphologically and semantically complex than neutral-register adjectives. To this end, all 3,747 adjectives listed in a current Modern Hebrew dictionary (Avneyon, 2007) were identified and classified into 19 morphological structures. Following extensive piloting on sampling methodology, this adjective bank was broken down into 38 lists, each containing about 100 different adjectives. 329 language experts provided 32,329 assessments of each adjective's register score on a scale of 1-5 (1 being neutral register, e.g., *adom* 'red', and 5 being very high register, e.g., *míti* 'mythical').

A model based latent class analysis (LCA) procedure produced six clusters of adjectives with different register scores and low degrees of variance among expert judges. For each cluster, a set of core adjectives were identified that had a likelihood of over 90% to belong to that cluster. This outcome enabled us (1) to expose the morphological make-up of the Hebrew adjective lexicon in terms of the different formal categories which express adjectival meaning; and (2) to construct a sequence of different-sized "register lexicons" from everyday and neutral to highly abstract and lexically specific, pinpointing the morphological composition of each such lexicon. As predicted, while clusters with low register scores contained a large variety of structural forms, clusters with higher register scores mostly contained semantically complex denominals and resultative passives. Moreover, within each morphological category, differential semantic properties were determined that explained the distribution of same-structure items across different register clusters. For example, –able *CaCiC* adjectives such as *amid* 'durable' mostly gravitated towards the higher-register clusters, while general *CaCiC* adjectives such as *bari* 'healthy' clustered with neutral-register adjectives. As corpus-generated Hebrew frequency lists are often flawed due to high homography, this analysis not only relates adjectival structures with semantic and lexical properties but also provides researchers with a reliable way to sample adjectives for psycholinguistic tasks.

Platform Session 3.3

13.00—13.20

Compound reading in natural discourse contexts

Peter Hendrix, Jonas Nick, Cyrus Shaoul, Harald Baayen

13.20—13.40

Discriminative learning and implicit morphology: Processing partially and exhaustively decomposable words

Petar Milin, Laurie Beth Feldman, Michael Ramscar, Harald Baayen

13.40—14:00

New evidence for the decomposition and composition of lexicalized English compounds

Robert Fiorentino

Compound reading in natural discourse contexts
Peter Hendrix, Jonas Nick, Cyrus Shaoul, Harald Baayen

Using a new large-scale database of eye-movements that were recorded while participants read a collection of samples from fictional texts, the Edmonton-Tübingen eye-tracking corpus (ET corpus), we investigated noun-noun compound processing in natural discourse contexts. The ET corpus contains over 500 hours of eye movements, for a total of more than 2,000,000 eye fixations. Despite the fact that noun-noun compounds have a relatively low frequency of occurrence, the ET corpus contained over 5,000 fixations on noun-noun compounds. As such, the ET corpus data allowed us to investigate compound processing in a naturalistic reading task, in which compounds were no more prominent than in everyday language use.

The ET corpus data indicate that presenting noun-noun compounds in natural discourse contexts has a considerable influence on the nature of compound processing. Previous experimental work, presenting compounds in isolation or in sentence contexts, demonstrated that a majority of compounds requires multiple fixations. By contrast, 61% of all compound tokens in the ET corpus were read with a single fixation. Compound processing for first-and-only fixations was primarily influenced by lexical characteristics of the compound as a whole, with significant effects of compound length and compound frequency on first fixation position and first fixation duration.

Additional fixations were necessary only for particularly long or infrequent compounds, or when fixation pattern planning was less-than-optimal: fixation positions were more leftward and incoming saccade lengths were longer for first-of-many fixations than for first-and-only fixations. The suboptimal fixation position for first-of-many fixations resulted in incomplete processing of the compound. Whereas first-and-only fixations were co-determined by lexical properties of the compound as a whole, we found significant effects of modifier length and modifier frequency on first-of-many fixation durations. The incomplete first-pass during first-of-many fixations is followed by a second fixation during which complete bottom-up information is available. The eye movement patterns for second fixations showed remarkable similarities to the eye movement patterns for first-and-only fixations, with significant effects of compound frequency and compound length for second fixation position and second fixation duration.

The pattern of results for compound processing in the ET corpus poses challenges to existing sublexical, supralexical and dual-route models of compound processing. As an alternative to these theories, we propose a naive discrimination learning (NDL) model (see, e.g., Baayen et al., 2011) that straightforwardly fits with the proposed eye fixation patterns for compounds in the ET corpus. The NDL model proposed here consists of two discrimination learning networks: an orthography-to-lexeme network that gauges the bottom-up support for the compound lexeme through its orthographic features and a lexeme-to-lexeme network that taps into higher level knowledge about co-occurrence probabilities of lexemes.

Through a series of simulations, we demonstrate that the NDL model provides a simpler and better account of the eye fixation patterns for noun-noun compounds in the ET corpus than do standard lexical predictors, as indicated by lower AIC scores and easier-to-interpret statistical models. The NDL simulations indicate that bottom-up measures of the support for the compound lexeme given the orthographic features that are available through the spotlight of visual attention provide excellent explanatory power for first-and-only fixation patterns. If the orthographic information available through the visual information uptake is insufficient to successfully process a compound in a single fixation, readers integrate the incomplete bottom-up information with higher level knowledge from the lexeme-to-lexeme network to arrive at a complete understanding of the compound.

Discriminative learning and implicit morphology: Processing partially and exhaustively decomposable words

Petar Milin, Laurie Beth Feldman, Michael Ramscar, Harald Baayen

In three experiments conducted in English, we used a forward-masked lexical decision task (48 ms soa) to compare exhaustively decomposable and partially decomposable form primes. The same target words were used across two prime types, together with unrelated primes (Experiment 1a and 1b) and identity primes (Experiment 2), ensuring optimal control for potential effects of morphological priming.

Generalized additive mixed modeling provided no evidence for a processing advantage of exhaus- tively decomposable primes as compared with partially decomposable primes. The two prime types, however, differed from both the unrelated primes and the identity primes.

A simulation study using naive discrimination learning (Baayen et al., 2011, NDL), trained on the 100 million words of the British National Corpus, offers precise predictions of the observed response latencies. In particular, these predictions are obtained without (obligatory) morpho- orthographic decomposition, and without explicit morpheme representations. The model shows that the identical priming effect for partially and fully decomposable primes is a straightforward consequence of shared letter bigrams.

Our computational model extends the original NDL model in a Bayesian way. It complements a given word's activation (understood as a *network likelihood*) with a measure of a word's entrench- ment in the network (taken to be its *network prior*). The *network posterior* is then estimated as a product (simple or tensor) of the network prior and likelihood.

The network posterior provided a fit to the data that matches the fit of an optimized statistical model with orthogonalized predictors representing a wide range of distributional variables for frequency of occurrence and neighborhood form similarity.

Our model explains neighborhood effects as arising during the process of (discriminative) learning. On the one hand, having many neighbors is detrimental to learning, as a word's letter bigrams have to compete for many different lexemes; weights become weak and the network likelihood becomes lower. On the other hand, lexemes with many neighbors acquire large negative connection weights; a greater network prior is a result of this error-driven learning. Taken together, neighborhood similarity in our model has two opposite effects: the larger the neighborhood, the weaker a word's likelihood becomes, and the longer its reaction time, but at the same time, a word's prior will be larger, leading to shorter reaction times.

New evidence for the decomposition and composition of lexicalized English compounds

Robert Fiorentino

Models positing that all putatively complex words are decomposed into morpheme-level representations must account for the processing of words with limited semantic transparency (e.g., *honeymoon*). Based on masked priming evidence that English compounds prime their constituents regardless of transparency, while primes with a word-initial or word-final pseudomorpheme do not yield priming, Fiorentino & Fund-Reznicek (2009) suggest that transparency may constrain post-decompositional processing of morpheme combinations, rather than precluding initial decomposition. However, they do not provide behavioral evidence that transparency indeed affects post-decompositional processing of their compounds. We thus test their primes as stimuli in a lexical decision task; both constituency and transparency effects should emerge if their compounds indeed undergo transparency-modulated post-decompositional processing (e.g., Ji et al., 2011).

Participants (N=20) completed a visual lexical decision experiment with stimuli including 38 relatively transparent compounds (TCW; e.g., *shoebox*), 38 relatively opaque compounds (OCW; e.g., *honeymoon*), 38 monomorphemic words with a word-initial pseudomorpheme (WIP; e.g., *stampede*), and 38 monomorphemic words with a word-final pseudomorpheme (WFP; e.g., *crimson*); stimuli were matched on a number of lexical properties. Nonwords included 100 novel compounds and 100 non-compound nonwords. Forty-eight lexicalized monomorphemic fillers were added to yield a 1:1 word:nonword ratio. Response times (RT) were analyzed using mixed models. If the compounds are processed via morphemes, we predict faster RT for the compounds than for the monomorphemic words (e.g., Ji et al., 2011, although previous studies did not systematically test monomorphemic stimuli with pseudoembedded morphemes). If transparency also affects processing, we further predict faster RT for transparent than for opaque compounds.

The results revealed an effect of constituency: TCW was faster than WIP (t = 10.072, p < 0.001) and WFP (t = 9.783, p < 0.001); likewise OCW was faster than WIP (t = 6.805, p < 0.001) and WFP (t = 6.588, p < 0.001). There was also an effect of transparency: response times were significantly faster for TCW than for OCW (t = 3.241, p < 0.01). A correlation analysis further illustrated that as rated transparency decreased, response time increased (r = -0.238, p < 0.039). This study thus provides new evidence that compound processing is both morpheme-based and modulated by transparency (see also Libben & Weber, 2014, among others). Together with Fiorentino & Fund-Reznicek (2009), these findings are consistent with accounts positing that complex word recognition involves across-the-board decomposition into morpheme representations and combinatorial processes operating on these representations.