11th International Conference on
& 20th Anniversary of
the Mental Lexicon

Edmonton, Canada
September 25 - 28, 2018

https://mentallexicon2018.ca

Keynote Speakers:
Mirjam Ernestus
Gabriella Vigliocco
Eleventh International Conference on the Mental Lexicon 2018

Edmonton, Alberta, Canada
September 25-28, 2018

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Welcome back to Edmonton!

Twenty years after the 1998 inaugural International Conference on the Mental Lexicon in Edmonton, the conference has returned. We are excited to have the event back where it all started two decades ago, and look forward to celebrating this occasion with you in Edmonton. We anticipate an exciting and engaging conference. We hope you will enjoy your time in Edmonton. We are excited to see so many of the mental lexicon veterans return, and we especially welcome the next generation of mental lexicon researchers, and hope that this gathering will consolidate existing relationships, create new opportunities, renew old collaborations, and facilitate the sharing of a diverse array of scholarly perspectives. We hope this gathering will set the stage and guide the future of this conference and mental lexicon research for the decades to come.
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Wednesday, September 26th

Platform Session 1.1
Chair: Debra Jared

08:00 - 08:40
Coffee / Registration

08:40 - 09:00
Welcome
Opening: Benjamin V. Tucker & Juhani Järvikivi

09:00 - 10:00
Keynote Lecture: Exemplars in Spoken Word Recognition
Mirjam Ernestus

10:00 - 10:20
Coffee Break

10:20 - 11:40
Platform Session 1.1

11:40 - 13:20
Lunch Break
Student/Postdoc Lunch & Learn / Networking Event
Hosted by Words in the World / Mots dans le Monde

13:20 - 14:40
Platform Session 1.2

14:40 - 16:20
Poster Session P1 and Refreshments

16:20 - 17:40
Platform Session 1.3

10:20–10:40
Identical Cognates Have Different Form Representations in Different Languages: Evidence from L1L2 Cognates and L2L3 Cognates in Trilinguals’ Lexical Processing
Dominiek Sandra, Ihor Biloushchenko & Ton Dijkstra

10:40–11:00
A Reassessment Of the Effects Of Neighborhood Density and Phonotactic Probability On L2 English Word Learning
Tsung-Ying Chen & Yi-Sin Sie

11:00–11:20
L1 Influences on L2 Morphological Awareness and Processing of English Derived Words
Zhaohong Wu

11:20–11:40
Cross-linguistic Similarity Effects in L1 and L2 Word Recognition
Jamie Taylor, Koji Miwa & Yoichi Mukai
Recent evidence supports the existence of multiple form representations for identical cognates. Moreover, these representations are accessed in a language non-selective way (Peeters, Dijkstra, & Grainger, 2013). We ran six experiments with unbalanced late trilinguals (L1: Dutch, L2: English, L3: French) and presented L1L2 cognates and L2L3 cognates in two types of decision tasks in L2. If identical cognates have a single form representation, both cognate types should be recognized faster than matched L2 controls, due to a cross-language cumulative frequency effect. If identical cognates have different form representations that can be accessed in a language non-selective way, L1L2 cognates should be recognized faster than matched L2 controls (recognition being mediated by the faster L1), whereas no such facilitation should be found for L2L3 cognates (recognition being mediated by the faster L2). Besides Cognate Type we manipulated List Composition and Experimental Task. Three list types were used: a pure L2 list (L2 words only), a mixed L1L2 list (L1 and L2 words), and a mixed L2L3 list (L2 and L3 words). Two experimental tasks were used: a generalized lexical decision task (GLDT) and a L2 go/no go task (GNGT).

Results
Linear mixed models were used to analyze the data.
L1L2 identical cognates
In the GLDT, responses to these cognates were facilitated (relative to L2 controls) in all three lists. In the GNGT, responses were inhibited relative to L2 controls, but only in the L1L2 list. Responses to L1L2 cognates were equally fast as responses to matched L1 controls.
L2L3 identical cognates
The only significant effect (relative to L2 controls) was a strong inhibition effect in the L2L3 list in the GNGT. Responses to L2L3 cognates were faster than to matched L3 controls.

Discussion
These findings support Peeters et al’s conclusion (a) that identical cognates have a different orthographic representation in each language and (b) that these representations are accessed in a language non-selective way. First, the absence of cognate facilitation for L2L3 cognates in the GLDT is not compatible with the idea that identical cognates should benefit from a cross-language cumulative frequency effect resulting from a single form representation. Second, the findings that L1L2 cognates and their L1 controls are recognized equally fast whereas L2L3 cognates are recognized faster than their L3 controls suggest that two form representations are accessed in a language non-selective way, with an access speed that depends on participants’ relative language proficiencies. Hence, L1L2 cognates’ representation in L1 is accessed before their representation in L2, as evidenced by the cognate facilitation effect that was found in the GLDT and the cognate inhibition effect that was found in the L1L2 list in the GNGT, i.e., when L1 was associated with the no-response. Furthermore, the representation of L2L3 cognates in L2 is accessed before their representation in L3, as evidenced by the absence of facilitation in the GLDT and by the presence of cognate inhibition when L3 was associated with the no-response (L2L3 list) and the task was sufficiently difficult to allow access to L3 (in the GNGT).
lexical consolidation hypothesis. All the sessions were administered using PsychoPy 1.85.3 (Peirce, 2007, 2009) on a laptop in a quiet room. Twenty-seven native speakers of Taiwanese Mandarin, who enrolled as college students in Taiwan and learned English as their L2 were recruited to the study.

**Results and Discussion**

The binary judgment data was analyzed in a mixed effects logistic regression model, which included ND, PP, token frequency of the Chinese translation (TransFreq), and target-competitor diverging point (DP) as main predictors and their interaction with test session (first vs. second). ND of the target words was quantified as the mean Levenshtein edit distance from the nearest twenty phonological neighbors from the corpus (PLD20; Yarkoni et al., 2008), and PP was calculated as the within-corpus mean bigram frequency of the target words. TransFreq was calculated from the Sinica Corpus (Academia Sinica, 1998). These three variables were log-transformed and z-scored prior to the analysis. Two predictors were found significant in the analysis (ND: $\beta = 0.375$, $z = 6.38$, $p < .001$; TransFreq: $\beta = -0.122$, $z = -2.41$, $p < .05$), and no significant interaction with test session was found. The lower accuracy of target words with a denser neighbor suggests a negative impact of lexical competition on L2 word learning. The inverse correlation between TransFreq and accuracy rates could be ascribed to a simple one-to-one lexical mapping between an L2 target word and a rare L1 lexical entry which, if unseen previously, is not associated with other L2 forms. In sum, the current study provides additional evidence to reassess the role of ND, PP, and other lexical factors in novel word learning. We will also discuss other notable differences between our and previous studies (e.g., the lack of both PP and lexical consolidation effects) as well as their implications for L1 and L2 novel word learning.

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**L1 Influences on L2 Morphological Awareness and Processing of English Derived Words**

_Zhaohong Wu_

There has been a growing interest in recent years on whether native (L1) speakers and second/foreign language (L2) learners process morphologically complex words in real-time in the same way when they silently read. Previous studies of L2 morphological processing are controversial regarding whether L2 learners decompose morphologically complex words similarly to native speakers (e.g., Clahsen, Felser, Neubauer, Sato, & Silva, 2010; Diependaele, Duñabeitia, Morris & Keuleers, 2011), and whether there are L1 influences on L2 morphological processing (e.g., Dowens, Vergara, Barber, & Carreiras, 2010; Jiang, Novokshanova, Masuda, & Wang, 2011; Silva & Clahsen, 2008). Previous studies have not systematically examined influence from different L1 morphological typologies, which may have contributed to conflicting results. The current study was the first to systematically examine (1) effects of L1 typology on L2 morphological awareness, and (2) effects of L1 typology, morphological awareness, and suffix complexity/productivity on L2 processing of derived words.

Three L2 English groups of typologically different L1s were recruited: Turkish (agglutinative, alphabetic), Chinese (isolating, logographic) and Vietnamese (isolating, alphabetic), along with a native English (analytic, alphabetic) control group. Participants’ morphological processing patterns were examined in a masked priming lexical decision task. Prime-target relations for word targets were (i) morphological (e.g., hunter-hunt), (2) opaque (e.g., corner-corn), (3) form (e.g., surface-surf), and (4) unrelated (e.g., eraser-hunt). Prime-target relations for nonword targets were (i) suffix (e.g., blemish-blem), (2) string (smudge-smud), and unrelated (e.g., learner-mape). Participants were then measured on their English morphological awareness in a series of computerized off-line tasks, and on their English proficiency using the LexTALE test (Lemhöfer & Broersma, 2012).

Results revealed clear effects of L1 morphological typological differences on L2 morphological awareness and morphological processing. In the morphological awareness tasks, the Turkish (but not Chinese or Vietnamese) group outperformed the English group even without accounting for language proficiency. The morphological processing results in the masked priming lexical decision task are consistent with the morphological
Cross-linguistic Similarity Effects in L1 and L2 Word Recognition
Jamie Taylor, Koji Miwa & Yoichi Mukai

In studies of bilingual visual word recognition, cross-linguistic phonological/semantic similarity and word frequency effects have been found among bilinguals of various language combinations, regardless of orthographic scripts used in the languages (e.g., Dijkstra, Miwa, Brummelheuis, Sappeli, & Baayen, 2010; Miwa, Dijkstra, Bolger, & Baayen, 2014). The vast majority of such evidence for cross-language non-selective activation comes from studies on bilinguals of alphabetic languages and those on L2 word processing.

The present lexical decision with eye-tracking study investigated the time-course of cross-language similarity effects with a group of 32 Japanese-English bilinguals reading in both their L1 and L2. This language combination allowed us to assess the effects of phonological and semantic similarity not contaminated by orthographic similarity. We conducted within-participant comparisons between L1 and L2 lexical processes to test whether cross-language similarity effects are asymmetrical in L1 and L2 readings, and, if so, what the nature of the asymmetry is and when it appears. In the L1 lexical decision task, participants responded to 250 words and 250 nonwords, and in the L2 lexical decision task, they responded to the corresponding English translation equivalents of these items. We also collected phonological and semantic similarity ratings from the same participants, expecting that individual participants’ own ratings offer more predictive power than averaged ratings. For phonological similarity, an objective measure based on Levenshtein distance was considered as well.

Response times were analyzed in addition to measures of early and late processing (i.e., first fixation duration and late fixation duration). In both L1 and L2 lexical decision tasks, cross-language semantic similarity was found to contribute during the later fixations. To our surprise, averaged cross-language similarity measures, but not participants’ own assessment of phonological/semantic similarity, co-determined response times and fixation durations. Despite these similarities, notable differences between L1 and L2 processing were found. L1 word frequency was found to contribute during L2 word recognition, while the inverse was not true in L1 lexical decision. Cross-language phonological similarity was found to contribute as a main effect in L2 lexical decision, while in the L1, this predictor was found to interact with L1 word frequency. Results are discussed from the framework of the Bilingual Interactive Activation (BIA+) model of lexical processing (Dijkstra & van Heuven, 2002).
An Investigation of the Relationship Between Reading and Speech Production in Children and Adolescents
Cassidy Fleming, Angela Cullum & Jacqueline Cummine

Purpose
Approximately 10-15% of children have reading difficulties, including developmental dyslexia and specific comprehension deficit (Bailey et al., 2016). Relationships between basic reading processes and brain structures in adults have been widely reported in neuroimaging literature (Cummine et al., 2015; Graves et al, 2010; Price, 2010, 2012). However, few studies have examined these relationships in children, and many face limitations of small sample size. The primary objective of this study is to examine the relationship between structural characteristics of the brain and reading performance across the developmental trajectory by using a combination of diffusion tensor imaging (DTI; i.e., fractional anisotropy), and volumetric magnetic resonance imaging (MRI; i.e., volume and thickness) measures.

Method
Child and adolescent participants aged 3 to 17 (n=444) were obtained from the Pediatric Imaging, Neurocognition and Genetics (PING) Study database (Gershon et al., 2013). Participants were included if they were 6 to 17 years of age, right handed, native English speakers, had completed the NIH Toolbox Oral Reading Recognition Test (TORRT; Casaleto et al., 2015), did not have vision or hearing problems and did not have a diagnosis of attention-deficit hyperactivity disorder. Volume, thickness and fractional anisotropy of brain regions and white matter tracts implicated in reading and speech production were extracted from the PING Study database, along with TORRT reading scores. Participants were divided into four age groups (years;months): 3.0 to 6.11, 7.0 to 11.5, 11.5 to 13.11 and 14.0 to 17.11. Blockwise multiple linear regression analysis was used to examine the relationship between age-corrected TORRT reading scores and DTI and MRI measures by age group, while controlling for potential confounds including prenatal alcohol exposure, parental education and occupation, household income, and racial minority status.

Results
The neural correlates of reading performance vary significantly across development and reflect the demands of reading
It is well known that how words sound plays a role in silent reading (Van Orden et al., 2005; Bitan et al., 2017; Wong and Chen, 1999). Thus far, models of reading building on naive discriminative learning (ndl, Milin et al., 2017) have not addressed the interplay of orthographic and phonological knowledge. We designed a novel mathematical model for reading that addresses this issue. This model, like ndl, is grounded in discrimination learning, but differs from ndl in two ways. First, instead of representing words’ semantics by lexomes, i.e., by pointers to semantic vectors in a distributional co-occurrence space (Landauer and Dumais, 1997), we now represent words’ semantics directly by semantic vectors, obviating the need for lexomes. Second, as a consequence of working with continuous instead of discrete representations, algorithmically, the model is no longer based on naive discriminative learning, but on linear discriminative learning. Linear discriminative learning can be implemented incrementally, using the learning rule of Widrow and Hoff (1960), or non-incrementally, using the mathematics of linear algebra. In what follows, we estimate the weights of networks using the latter method.

As a first step, we defined a cue matrix C that specifies for each of 11,480 words which letter trigrams (out of a total of 3465) they contain. In addition, we defined a matrix S that specifies, for each of these 11,480 words, a semantic (row) vector. The semantic matrix S was derived from the TASA corpus (Landauer et al., 1998) using naive discriminative learning (Baayen et al., 2016). We defined a matrix F mapping C onto S by solving $S = CF$. The mapping F can be conceptualized as a two-layer network trained to predict semantic vectors from word’s trigrams. This mapping represents a direct route from form to meaning. We denote the estimated semantic vectors by Ŝ. As a second step, we designed an indirect route Ŝ = CHG, with H mapping step, we designed an indirect route Ŝ = CHG, with H mapping resulting triphone vectors onto S.

We first evaluated the recognition accuracy of the two routes. Recognition was defined as successful when the predicted semantic vector ŝ had the highest correlation with the target word’s actual semantic vector s. The indirect route (accuracy 71%) outperformed the direct route (accuracy 59%) by 12%. If the two routes were implemented with ndl, accuracies dropped to 40% and 27% for the indirect and direct route respectively.

For any given word, we obtained two semantic vectors, one produced by the direct route, s1, and one produced by the indirect route, s2. For each of these vectors, we estimated the activation diversity $\alpha$, defined as the L-1 norm of the vector. Following Milin et al. (2017), we also calculated for each word the L-1 norm of its column vector in S, to which we refer as its prior. We refer to the correlation of s1 and s2 as a word’s self-correlation $r$, and to the sum of its two activation diversities as the total activation diversity $\alpha_t = \alpha_1 + \alpha_2$. We used these measures to predict the (in-
In the present study, we investigate the role of phonological information in visual word recognition by adopting a large-scale data-driven approach that exploits a new consistency measure based on distributional semantics.

Recently, it was shown that Orthography-Semantic Consistency (OSC) – i.e., the consistency between an orthographic string and the meanings to which it is associated in a large corpus – is a relevant predictor in lexical decision experiments (Marelli et al., 2015). OSC is operationally defined as the degree of relatedness of a word meaning and the meaning of all the members of its orthographic family, that is, all the words that “contain” the target word.

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

We tested both OSC and PSC on lexical decision response latencies to 533 words containing grapheme sequences that are associated to multiple phonological forms extracted from the BLP (Keuleers et al., 2012). Results showed that both orthography and phonology are activated during visual word recognition. However, their contribution is crucially determined by the extent to which they are informative of the word semantics, with phonology playing a crucial role in accessing word meaning, as determined by a mediation analysis.

To characterize the time-course of the effect that we observed in behavioral data, we further tested the impact of both PSC and OSC on ERP responses in a lexical decision task using the Kilo-Word database (Dufau et al., 2015). Preliminary results confirm the pattern observed in response times, and indicate that the interaction between PSC and OSC emerges as early as 200ms.

This is a direct evidence that readers use phonological information to activate semantics, even when the task would not apparently require it (visual word recognition).

References


The phonological-orthographic consistency effect on reduced word forms in Japanese:
Evidence from pupillometry with a delayed naming task

Yoichi Mukai, Juhani Jarvikivi & Benjamin V. Tucker

Evidence for activation of spelling during the comprehension of spoken words comes from studies investigating phonological-orthographic (P-O) consistency. These studies reveal that the extent to which pronunciation is consistently reflected in spelling affects the recognition of spoken words. In English, for example, the rhyme /-ak/ is consistently reflected in spelling as it has only one possible spelling “-uck”, but the rhyme /-ip/ is not because it has two possible spellings “-eap” or “-eep”. The recognition of inconsistently spelled words, such as keep, is slower than consistently spelled words, such as luck (Ziegler & Ferrand, 1998). It remains, however, unclear whether the P-O consistency effect interacts with the actual pronunciation of the word (i.e., phonetic word form) or the representational form of the word (i.e., phonological word form). In conversational speech, there are many instances of articulatory undershoot, weakening the acoustic information of segments and possibly changing or deleting segments. For instance, yesterday /ˈjɛʃəɹ/ could be pronounced /ɛʃəɹ/ (Ernestus & Warner, 2011). In the present study, we examine whether the P-O consistency effect interacts with the phonetic word form or the phonological word form. If the effect interacts with the actual phonetic word forms, the changed and deleted segments, as well as the weakened acoustic information of segments, could create an additional mismatch between pronunciation and spelling. If the effect interacts with the phonological word form, the impact of the changed, deleted, and weakened segments would be minimal.
Thirty-eight participants' pupillary responses were measured during the perception of Japanese words as they performed a delayed naming task. We used 226 lexical items, each of which contained both reduced and canonical word forms, resulting in 452 total stimuli. All stimuli consisted of a word-medial nasal or voiced stop in disyllabic and digraphic words. Pupil dilation measure is beneficial for this experiment as it can reflect the magnitude of cognitive effort over time in the absence of voluntary and conscious processes (Laeng, Sirois, & Gredebäck, 2012). We analyzed the data with generalized additive mixed models, which allow for modeling non-linear relationships and controlling for autocorrelation in time-series data such as pupil dilation (Wood, 2006).

Our results demonstrate that the amount of cognitive effort required to process reduced word forms was higher than that of canonical word forms. This result is in line with previous research (e.g., Kemps, Ernestus, Schreuder, & Baayen, 2004). The P-O consistency effect was observed in both reduced and canonical word forms, and the magnitude and direction of the effects were comparable between the two forms. This means that the phonetic mismatch between pronunciation and spelling in reduced word forms does not have an additional impact, suggesting that the P-O consistency effect interacts with phonological word forms. This result reflects two possible implications. First, the deleted and changed segments in reduced word forms are restored, as reduced word forms are connected to the canonical word forms in the mental lexicon (Kemps et al., 2004).

Poster Session P.1 And Refreshments

14:40-16:20

1. Large Database of English Compounds (LADEC): An Overview and an Investigation of Semantic Transparency
Christina Gagne & Thomas Spalding

2. Pseudo-morphemic Structure Inhibits, but Morphemic Structure Facilitates, Processing of a Repeated Free Morpheme
Christina Gagne, Thomas Spalding, Kelly Nisbet & Caitrin Armstrong

3. Configural Cues in Language: A Naive Discriminative Learning Approach
Geoff Hollis

4. The Effects of Chinese Word Structure on Categorization and Perception: Evidence from ERPs
Xuan Pan & Debra Jared

5. Cross-language Activation of Meaning by Phonology in Sentence Reading
Debra Jared, Deanna Friesen, Veronica Whitford, Olivia Ward & Debra Titone

6. A Cluster Analysis Approach to Assessing Vocabulary and Targeting Intervention
Aleka Akoyunoglou Blackwell

7. A Cross-linguistic Investigation of Response Time Distributions in Lexical Decision
Peter Hendrix

8. Gender Stability in Russian Expressive Nouns
Natalia Chuprasova, Varvara Magomedova & Natalia Slioussar

Svetlana Alexeeva & Natalia Slioussar

10. Decay of Stem-final Consonant Mutations in Ukrainian
Anna Smetina, Varvara Magomedova & Natalia Slioussar

11. Speech Production in the Discriminative Lexicon
Harald Baayen

12. Modeling Auditory Word Recognition with Linear Discriminative Learning
Elnaz Shafaei Bajestan & Harald Baayen

13. Morphological Processing across the Lifespan: Evidence from Number-dominant Nouns
Svetlana Malyutina & Elena Savinova

14. A Semantic Vector Model for the Indonesian Prefixes pe- and peN-
Karlina Denistia, Elnaz Shafaei Bajestan & Harald Baayen

15. Massive Auditory Lexical Decision: Investigating Performance in Noisy Environments
Brant Harker, Michelle Leung, Filip Nenadić, Danièle Fonseca, Spenser Halfyard, Matthew Kelley, Pearl Lorentzen, Melina Sinclair & Benjamin V. Tucker

16. Synonyms in the Mental Lexicon and Mutual Exclusivity
Elena Nicoladis & Angélique Laurent
17. Syntactic Category Facilitates Rather Than Inhibits Lexical Competition  
Christina Gagne, Thomas Spalding, Kelly Nisbet and Caitrin Armstrong

18. Emotion and Lexical Effects in an Auditory Lexical Decision Task with Vocal Affect  
Graham Tomkkins Feeny, Juhani Jarvikivi & Benjamin V. Tucker

19. How Does Text Interest Interact with Benchmark Predictors and Semantic Variables While Reading?  
Constance Imbault & Victor Kuperman

20. MEG Responses Track Lexical Processing of Continuous Narrative Speech  
Christian Brodbeck and Jonathan Z. Simon

21. I Bet I’ll Remember “Biochemistry” — Metamemory as a Function of Lexical Features and Language Background  
Grace Lin, Rachel Smith, Chelsea Pelleriti, Masha Jones & Susanne Jaeggi

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Large Database of English Compounds (LADEC): An overview and an investigation of semantic transparency  
Christina Gagne and Thomas Spalding

In this presentation, we provide an overview of a database of English compounds and then use the database to examine questions related to semantic transparency. Linguistic and psycholinguistic research has benefitted greatly from the use of large scale databases from which researchers can select stimuli for their work based on various criteria. LADEC fills a need for a comprehensive database of English compounds with relevant linguistic and psycholinguistic variables. Existing databases (e.g., CELEX, Baayen et al. 1993; BLP, Keuleers et al. 2012; ELP, Balota et al. 2007) are useful, but are not ideally-suited for research on compound words. First, compound words cannot be readily extracted from these sources. For example, a search in the ELP for bi-morphemic items returns items such as bulls, and vindicate in addition to compounds. The BLP identifies complex words, but this category includes words such as blazer and boorish in addition to compounds. Second, the set of compounds is restricted. The BLP database, for example, includes only monosyllabic and bisyllabic words, and, consequently, multi-morphemic compounds (e.g., thunderstorm and bumblebee) are excluded. Third, the databases do not include measures (e.g., semantic transparency) that are particularly relevant to compounds.

The LADEC database consists of nearly 17000 English words that can be parsed into two free-morphemes. Morpheme length was restricted to 3 to 8 letters. No restrictions were placed on the constituents in terms of morphemic structures; both monomorphemic (e.g., wheel) and multi-morphemic (e.g., teacher) constituents were used. The items were selected from a range of sources including CELEX, ELP, BLP, British National Corpus (BNC) and Wordnet, and were hand-coded in terms of being a compound (e.g., snowball) or noncompound (e.g., carpet). We obtained linguistic characteristics (e.g., frequency, family size, and family frequency) for each item as well as psycholinguistic properties such as semantic transparency.

The notion of semantic transparency has played a central role in evaluating competing theories of compound representation and processing. Thus, we had participants rate each compound in terms of how predictable its meaning is from its parts, as well as the extent to which each constituent retained its meaning in the compound. In addition to these ratings, we used Latent-Semantic-Analysis (Landauer & Dumais 1997) and snaut (Mandera et al., 2017) measures of semantic association between the constituents and the compound. We compared these different measures in terms of how they compare to each other as well as how they predict behavioural data such as lexical decision times. Doing so allows us to test a variety of hypotheses such as whether meaning retention ratings reflect the semantic similarity between a compound’s meaning and the constituent meaning, whereas the predictability ratings indicate the degree of semantic compositionality of the compound’s concept (see Marelli & Luzzatti 2012), and whether transparency is more than a simple function of semantic association and includes other factors such as the ease with which the two constituents can be integrated into a unified representation (see Fiorentino & Poeppel 2007; Gagné & Spalding 2009; Koester et al. 2007; Kounios et al. 2003).

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Pseudo-morphemic structure inhibits, but morphemic structure facilitates, processing of a repeated free morpheme  
Christina Gagne, Thomas Spalding, Kelly Nisbet and Caitrin Armstrong

The aim of this project is to investigate whether the language system recovers embedded morphemes and attempts to create a morphemic structure whenever potential morphemic representations are available, regardless of whether it is appropriate. To do so, we investigate (in five masked priming lexical decision experiments) whether exposure to a pseudo-compound affects the subsequent processing of an embedded morpheme (e.g., carpet-car). Pseudo-compounds comprised of two free morphemes provide no overt cues as to whether a compound structure is appropriate (i.e., orthographic decomposition will yield two morphemes) and, thus, they are ideal for examining whether the system automatically attempts to construct a compound mor-
phemic structure whenever morphemes are recovered. We also examined the impact of a semantically opaque compound on the subsequent processing of its constituents (e.g., honeymoon-honey).

We found that the presence of an embedded morpheme in a word affects the subsequent processing of those embedded morphemes and that the effect depends on a mixture of facilitation due to the orthographic overlap and inhibition that depends on whether the target functions morphologically in the prime. Exposure to a word in which the target does not function as a morpheme made it more difficult (relative to an unrelated prime) to identify that target as a word (e.g., carpet-car), whereas exposure to a word in which the target was a productive morpheme made it easier to process the target (e.g., hogwash-hog). These effects cannot be reduced to semantic, orthographic, phonological, or syllabic overlap, and also occurred regardless of whether the mask and prime duration was longer or shorter.

Taken together, these results indicate that the repetition of orthographic units is generally beneficial, but that morphology also plays a role by influence whether we observe a repetition benefit due to the orthographic units being repeated from the prime to the target. The presence of non-productive morphemes in the prime leads to suppression of those morpheme. Consequently, the benefit of the repetition of orthographic units was removed when the units did not also function as a morpheme (e.g., sonnet-son). In contrast, the presence of productive morphemes in the prime did not lead to suppression of the word-initial embedded morpheme and, thus, did not offset the benefit of orthographic repetition (e.g., hog benefited from hogwash).

These data contribute to the ongoing debate in the literature about whether decomposition occurs for all words or only for semantically transparent words. The finding that participants processed pseudo-compounds as though they were morphologically complex is consistent with claims that word recognition involves morpho-orthographic segmentation and that this process occurs irrespective of semantic transparency (e.g., Feldman et al., 2012; Fiorentino & Fund-Reznicek, 2009; Gagné & Spalding, 2003; Ji, Gagné, & Spalding, 2011; Libben, Gibson, Yoon, & Sandra, 2003) and also irrespective of whether the word is fully decomposable into morphemes (e.g., the prime career led to processing difficulties for the embedded morpheme car even though car and eer do not function as morphemes in the mono-morphemic word career). Critically, our results show that the effects of the primes on the processing of the targets depend on a mixture of facilitation due to the orthographic overlap and inhibition that depends on whether the embedded morpheme is used productively or non-productively in the prime.

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**Configural Cues in Language: A Naive Discriminative Learning Approach**

*Geoff Hollis*

The Rescorla-Wagner model has recently been applied to modelling varied phenomena in lexical processing (Baayen 2010; Baayen et al., 2011; Baayen et al., 2011; Baayen et al., 2016). In order to solve linearly nonseparable problems, the Rescorla-Wagner model must have access to configural cues (i.e., the particular organization of discrete cues is itself a cue; Miller et al., 1995). Needing access to configural cues in order to solve complex learning problems is reflected in applications to language processing as the decision to use bigram and trigram sequences, rather than letters or phonemes, as cues (e.g., Baayen et al., 2016). However, the introduction of configural cues into the Rescorla-Wagner model raises a conceptual issue: animals must track the value of some configural cues, however they cannot track the value of all such cues, due to combinatorial explosion (e.g., Baayen et al., 2013). Little has been said either in the animal learning literature or the lexical processing literature on how or when such cues become part of the animal’s learning environment. We introduce a refinement to the Rescorla-Wagner model that is capable of autonomously adding configural cues to its repertoire based on the detection of linearly nonseparable learning patterns. When applied to learning contingencies in a corpus of real text, the configural cues acquired by the model have high face validity as meaningful lexical units.

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The linguistic relativity hypothesis (Whorf, 1956) claims that speakers of different languages perceive and conceptualize the world differently. More specifically, the Label-feedback Hypothesis (Lupyan, 2012) proposes that linguistic labels provide top-down feedback to conceptual and perceptual representations. The present study tested the Label-feedback Hypothesis by capitalizing on an interesting feature of Mandarin Chinese. In English, most nouns do not provide linguistic clues to their categories (exceptions are sunflower and bluebird), whereas in Mandarin Chinese, some nouns provide explicit category information morphologically (e.g., the morpheme 鸟 bird in the noun 鸟瞰 豹 鸟 号 and 知鸟 罗宾), while some nouns do not (e.g., 企鹅 penguin and 鸽子 pigeon). In Experiment 1, a categorization task with ERP was used. Chinese-English bilinguals and English monolinguals were asked to judge the membership of atypical (e.g., ostrich, penguin) vs. typical (e.g., robin, pigeon) pictorial exemplars of various categories (e.g., bird). Half of the pictures in each group had a category clue in their Chinese name and half did not. In one version of the experiment, the category names that appeared before each picture were written in English, and in a second version they were written in Chinese. English monolinguals were given only the English version, and as expected, they showed a large N400 typicality effect regardless of whether or not the picture name had category clues in Chinese. In contrast, when tested in Chinese, Chinese-English bilinguals showed a large typicality effect in the N400 only for pictures without category clues in their name (e.g., penguin, pigeon). Interestingly, when Chinese-English bilinguals were tested in English, the N400 typicality effect was smaller for the pictures with category clues in their Chinese names than pictures without clues. These results demonstrate that linguistic information embedded in object names has an effect on people’s categorization processes and category representations. Furthermore, linguistic information in bilinguals’ L1 has an effect on their categorization processes even when they are using their L2. In Experiment 2, a visual oddball detection task with ERP was used. Pictures of four birds (ostrich, robin, penguin, and pigeon) were used as critical stimuli. Half of them have a category clue in their Chinese names (ostrich-robin), and half of them do not (penguin-pigeon). Chinese native speakers and English monolinguals were asked to view 4 blocks of continuous flow of pictures and respond to a target picture (squirrel). In two blocks, pictures of ostrich and robin were used as standards and deviants. In the other two blocks, pictures of penguin and pigeon were used. The visual mismatch negativity elicited by deviant stimuli was significantly larger for pairs without category clues (penguin-pigeon) than pairs with clues (ostrich-robin) in Mandarin Chinese speakers, but it was similar for the two pairs in English speakers. These results demonstrate that linguistic information embedded in object names affects people’s object perception implicitly.

References
A Cluster Analysis Approach to Assessing Vocabulary and Targeting Intervention  
Aleka Akoyunoglou Blackwell

According to Pearson et al. (2007), vocabulary assessment “has been driven by tradition, convenience, psychometric standards, and a quest for economy of effort rather than a clear conceptualization of its nature” (282). We respond to this critique by proposing a model of vocabulary assessment aimed at capturing the complexity of lexical knowledge, i.e., the difference between breadth and depth of vocabulary knowledge, as well as the incremental nature of vocabulary growth. Our assessment paradigm includes three measures of different dimensions of vocabulary knowledge:

(i) the PPVT-III (Dunn, 1997), an orally-administered test of receptive word knowledge, spanning a range of word frequency levels, and relying on picture matching;
(ii) the Word Associates Test (WAT) (Read, 1998), a multi-select association task for adjectives with synonyms, collocates, and distractors; and
(iii) the Verb Subordinates Test (VST) (Blackwell, 2012), a forced choice test of knowledge of superordinate-subordinate verb relations at four verb frequency levels.

Two hundred thirty native English-speaking college students (Age Mode = 18, Mdn = 19, M = 20.23, Min = 18, Max = 36, SD = 3.4) enrolled in a large public university in the United States participated in the study. Participants completed all the vocabulary measures in one session in three adjoining examination rooms. The three vocabulary measures were given to participants in counterbalanced order. The PPVT-III was administered by a trained experimenter in a private room. The WAT was administered as a paper-pencil test at a large conference table in an adjoining room. The VST was administered in a third room on a computer with the software E-Prime which recorded both item response and response latency. The PPVT-III was scored per its instructions. The WAT was scored on an 8-point/item scale. The VST was scored by the computer software. The E-prime task malfunctioned during one administration. We, therefore, report results on 229 participants. Given the three different measurement scales, raw scores were normalized and z-scores were used in data analyses.

We present descriptive statistics and intercorrelations (ranging from .455 to .618, p < .001) followed by results from a K-means cluster analysis which revealed a six-cluster classification. Findings show how employing a cluster analysis approach to assessing vocabulary knowledge allows us to classify individuals into lexical ability groups more accurately than is possible when relying on any one single vocabulary assessment measure. We validate our proposed classification, and by extension our assessment paradigm, by comparing the processing speed of individuals in the different clusters under the typical single-test paradigm vs. our paradigm.

The major contributions of our work are two-fold. First, the proposed paradigm offers far deeper insight into the relationship between depth vs. breadth in vocabulary knowledge at the low vs. high end of the word knowledge spectrum. Second, our assessment paradigm has practical implications by making clear predictions regarding the best combination of vocabulary tests for specific clusters of students, followed by targeted vocabulary instruction in terms of depth vs. breadth of word knowledge for each specific cluster.

A Cross-linguistic Investigation of Response Time Distributions in Lexical Decision  
Peter Hendrix

The analysis of psycholinguistic data typically focuses on the mean of the response variable distribution. A least squares regression of the response times in a lexical decision experiment, for instance, estimates the conditional mean of the response time distribution given one or more lexical predictors, such as the length or frequency of a word. Effects of lexical predictors, however, need not be constant over the response time distribution. The effects of some predictors may primarily influence short reaction times, whereas the effects of other predictors may be more prominent for long reaction times. Furthermore, the qualitative nature of predictor effects may be different for different parts of the response time distribution.

Distributional analyses provide more insight into the temporal dynamics of predictor effects in behavioral experiments. The (relative) timing of predictor effects is crucial for the development of psycholinguistic theories and models. Distributional analyses therefore have the potential to uncover valuable information about the nature of lexical processing that is not available through more traditional analysis techniques. Here, we present a cross-linguistic distributional analysis of lexical decision latencies that is based on the principles of time-to-event analysis.

Time-to-event analysis estimates the time at which an event of interest occurs. In lexical decision the event of interest is the “word or non-word” decision. Recently, time-to-event analysis techniques have been developed within the framework of generalized additive models (Hastie & Tibshirani, 1986; Wood 2006; Wood 2011). In particular, piece-wise exponential generalized
In this paper, we study grammatical gender of Russian expressive nouns (augmentatives and diminutives). Russian has three genders (M, F and N). The gender of the noun cannot be unambiguously determined from its inflectional affixes, but the majority of nouns ending in -a/ja in nominative singular are F, most nouns ending in a consonant are M, and almost all nouns ending in -o/e are N.

Most previous studies (e.g. Vinogradov 1972; Corbett 1982) assume that expressive nouns preserve the gender of the base. Several authors (Savchuk 2011; Sitchinava 2011) have noted the
EVIDENCE FOR MIDDLE LETTERS SALIENCE IN VISUAL WORD RECOGNITION IN RUSSIAN

Svetlana Alexeeva & Natalia Slioussar

Experiments with orthographic neighbors are one of the main methods to study letter processing during visual word recognition. In this paper, we study the role of letter position for lexical access. Although this factor is expected to play an important role, previous studies show that its significance depends on the task.

In the previous priming studies using nonword substitution primes, if a prime and a target had only one out of four letters in common, word initial priming was more pronounced compared to the other conditions (Humphreys et al., 1990). With two out of four shared letters, word-final priming was shown to be the most effective. If only one out of four letters was different, the substitution position was not found to be significant. As for the last observation, similar findings were reported in the experiments with four letter Dutch words (Grainger, 1988) and five letter English words (Chambers, 1979): interference by a high frequency neighbor was found to be independent of the substitution position. At the same time, in perceptual tasks such as letter search initial and final letters were processed faster than middle letters, which points to their special role (e.g. Bouna 1973; Gomez et al. 2008; Tydgat, Grainger 2009). These discrepancies call for further research.

We conducted two masked priming lexical decision experiments on Russian. In Experiment 1 primes were presented for 150 ms, and in Experiment 2 they were displayed for 60 ms. All primes were nonwords, five-letter targets were real nouns in nominative singular or nonce nouns. Two features were manipulated: whether the prime was a one-letter substitution nonword neighbor of the target (experimental vs. control condition); whether the substituted letter was word-initial, word-final or word-medial (e.g. rivan, disan, divap, and sifar for the target divan ‘sofa’).

In both experiments all neighbor primes significantly decreased response latencies compared to the control condition, as in many previous studies. Surprisingly, in Experiment 1 (150 ms) the substitution in the beginning significantly increased the size of the priming effect compared to the middle of the word, and so did the substitution at the end, although this tendency did not reach significance. In other words, the substitution in the middle of the word was more noticeable than in the beginning. This partially replicates our findings from a previous experiment with real word primes, in which the priming effect was found to be more pronounced in the case of word-final letter substitutions than in the case of word-middle ones (word-initial letter substitutions were not included) (Slioussar, Alexeeva, 2017). In Experiment 2 (60 ms), no significant differences were found between the three experimental conditions. Together, these results show that although word-initial and word-final letters are known to be more salient in perceptual tasks and in some cases in priming tasks in English (see above), they might be less important for candidate activation during lexical processing in Russian. These findings could be related to the existence of variation in colloquial Russian, but the extent of this variation and well as the factors that may influence it have not been studied before. Nevertheless, it is clear that the main trigger of the variation is the change of the inflectional (sub) class brought by the suffix, as in (1).

(1) domM ‘house’ > dom-in-aM/F ‘big house’; kotletaF ‘cutlet’ > kotlet-iS-e ‘big cutlet’

We conducted an experiment: participants received a list of 7 adjectives and then were presented with expressive nouns one by one. They were asked to pick a matching adjective and pronounce the resulting phrase. While they may have guessed that the experiment was about connotations of different expressive suffixes (adjectives had meanings like ‘big’, ‘small’, ‘cool’ etc.), our goal was to analyze gender agreement on the adjective.

Participants were 30 native Russian speakers (17 women), aged 19–30. There were 50 stimuli (real and nonce expressive nouns) and 44 fillers. 3 factors were manipulated: the gender of the base word (M/F), the final segment of the derivate (consonant, -a/ja, -ο/e), and animacy (nouns denoting people / animals / inanimate objects).

1200 answers were recorded. In 614 cases (51%) the genders of the base and the derivate were different. All changes were triggered by the final segment of the derivate, but the distribution of the assigned genders was uneven: 47% of consonant-final nouns, 15% nouns ending in -a/ja and 38% nouns ending in -ο/e changed their gender to M, F and N, respectively. The differences were statistically significant (we used mixed effects logistic regression). The base gender factor was also significant: 75% M nouns and only 25% F nouns preserved their gender. Animacy did not play a role.

Firstly, these results are noteworthy because gender change with expressive suffixes has not been studied previously. Secondly, they are interesting in the light of the discussion on markedness in the Russian gender system. In terms of frequency, M < F < N, but N is used as the grammatical default, e.g. in impersonal sentences. As a result, N is assumed to be unmarked in several formal models (Nevins, 2011; Kramer, 2015), while several experimental studies of noun-adjective agreement assume M to be default (Akhutina et al. 1999, 2001; Romanova, Gor 2017). Rice (2009) argues that on the word level, M is unmarked. Corbett & Fraser (2002) claim that on the phrase level, the default gender is N, and on the word level it is M. Slioussar & Malko (2016) who studied gender agreement attraction found that N behaved as unmarked in production, while M did so in comprehension. They proposed that apart from markedness, features have a property of stability, and M is the most stable gender. Our results are compatible with this suggestion.

Another point is that variation in gender assignment would present a challenge for Distributed morphology analysis. For the variation observed gender and declension class should be both syntactic features allowed to interact in a probabilistic manner. Steriopolo (2017) analyzes the gender variation using the DM framework with common gender, however our data show that even the inanimate nouns that cannot have common gender, show variation.
to different properties of orthographic neighborhoods in Russian and English. Alexeeva et al. (2017) show that in Russian, the average number of substitution neighbors always increases when a larger text corpus is taken, while the opposite happens in English. Trying to account for this, the authors mention that the majority of substitution neighbors in Russian constitute words and word forms that differ in affixes (e.g. zañesti ‘to drop smth off’ vs. naneñi ‘to apply’; sëñtra ‘sisterNOM.SG’ vs. sëñtr ‘sisterGEN.SG’) whereas in English substitution neighbors normally differ by their roots. Therefore we speculate that the middle letter salience in Russian may be explained by the root location (roots are typically word-middle). Supported by RFBR#18-012-00837.

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Decay of Stem-final Consonant Mutations in Ukrainian
Anna Smetina, Varvara Magomedova & Natalia Slioussar

In this paper, we present the results from our study of the decay of stem-final consonant mutations (palatalization) in Ukrainian. Ukrainian has two types of Slavic Palatalization, formerly phonologically conditioned, see examples in (i).

(i) First Slavic Palatalization: k à č, g à ž, x à š (ruka ‘handNOM’ – v ruce ‘in handLOC’) Second Slavic Palatalization: kàć, gàž, xàš (ruka ‘handNOM’ – ručka ‘little hand’) Consontant mutations of the first type can be found in some verbs, adjectives and nouns while second type mutations are obligatory present in a paradigm (locative case) of any noun with a stem ending in velar. Hence, mutations of the first type are more widespread, while mutations of the second type are more regular.

We have compared novel nouns in locative vs diminutive and augmentative forms using an online survey. Participants (25 Ukrainian native speakers, 21-48 years old) were asked to put nouns in an adequate form according to the context. The experiment had three sections: locative, expressive forms and locative/expressive forms of pseudowords.

We have found that for the locative case speakers have an avoidance strategy – they use suffix ‘-u’ that does not require consonant mutation instead of a normative locative suffix ‘-e’ that requires mutation. For the expressive forms there was no avoidance strategy used.

The data show that expressive nouns lack mutation signifi-
cantly less often than locative forms even after we have excluded the avoidance strategies from the data.

The decay of stem-final consonant mutation takes place in the modern Ukrainian, and the mutations of the second type (Second Slavic Palatalization) look to be more vulnerable. It could be caused by two major factors. First, the First Slavic Palatalization may be more resilient to the decay in general. Second, it may be more resilient to the decay because this is the one that is still used in Russian (Russian influence). However, in our data the geographic factor (form which part of the Ukraine is the speaker) was not significant.

Third, the expressiveness itself may help mutation to resist the decay. Alderete & Kochetov (2017) have shown that diminutive and affectionate toned can be expressed with palatalization in many languages in a "sound symbolism" kind of way. According to (Alderete & Kochetov, 2017) palatalization and affrication are central for the expressive change, and this is exactly what happens with stem-final consonant mutations triggered by the expressive suffixes.

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Our goal was to see if the stem-final velar mutation still applies to novel and recently loaned words and if there is a decay of mutations what strategies do speakers use.

Speech Production in the Discriminative Lexicon
Harald Baayen

The discriminative lexicon is introduced as a mathematical and computational model of the mental lexicon. This novel theory is inspired by word and paradigm morphology, but operationalizes the concept of proportional analogy using the mathematics of linear algebra. It embraces the discriminative perspective on language, rejecting the idea that words' meanings are compositional in the sense of Frege and Russell, and arguing instead that the relation between form and meaning is fundamentally discriminative. The discriminative lexicon also incorporates the insight from machine learning that end-
to-end modeling is much more effective than working with a cascade of models targeting individual subtasks. The computational engine at the heart of the discriminative lexicon is linear discriminative learning: Simple linear networks are used for mapping form onto meaning, and meaning onto form, without requiring the hierarchies of post-Bloomfieldian ‘hidden’ constructs such as phonemes, morphemes, and stems. We show that this novel model meets the criteria of accuracy (it properly recognizes words, and produces words correctly), productivity (the model is remarkably successful in understanding and producing novel complex words), and predictivity (it correctly predicts a wide array of experimental phenomena in lexical processing). The discriminative lexicon does not make use of static representations that are stored in memory and that have to be accessed in comprehension and production. It replaces static representations by states of the cognitive system that arise dynamically as a consequence of external or internal stimuli. The discriminative lexicon brings together visual and auditory comprehension as well as speech production into an integrated dynamic system of coupled linear networks.

In this presentation, special attention is paid to the initial stage of speech production: the mapping of meaning onto form. It will be demonstrated for some 10,000 word forms that a linear mapping from semantic vectors onto vectors specifying which triphones a targeted word contains can be achieved with high accuracy (92% for inflected words, 99% for monomorphic words). Importantly, weak links in the chain of trigrams are typically found where paths in the trigram graph fork, i.e., at the boundaries of stems and exponents. Thus, the model predicts increased processing costs at these boundaries. This prediction was confirmed for segment durations at such boundaries as attested in the Buckeye corpus, which are longer when the support from semantics is reduced. The model therefore also explains why in typing, inter keystroke intervals increase at such boundaries. Thus, “morphological” effects emerge in this model without any representations for morphemes, stems, or exponents being necessary.

**Modeling Auditory Word Recognition with Linear Discriminative Learning**  
Elnaz Shafaei Bajestan & Harald Baayen

Arnold et al. (2017) proposed a cognitive model for auditory word recognition based on naive discriminative learning (NDL). Their two-layer network model was trained to discriminate between lexomes (lexical units linking to semantic vectors) on the basis of acoustic features derived from the speech signal (Frequency Band Summary Features). Arnold et al. tested their model on German isolated word recognition, and reported that the model’s identification accuracy was within the range of human listeners. For the general framework for auditory comprehension of continuous speech, of which the present model is a central part, see Baayen et al. (2016).

The present study is a follow-up to Arnold et al.’s work that tests and extends the model on American English, taken from the archive of the Distributed Little Red Hen Lab (co-directed by Francis Steen and Mark Turner). Average model accuracy was at 11.58% under 10-fold cross validation for 20 hours of clean speech with little or no background noise. When trained on 20 hours of speech with background noise (trac, music playing), performance went down by only 1%. Model performance improved when trained on 50 hours of clean speech. Further improvement in word recognition accuracy by more than 1% was achieved by feeding the output of the NDL network into a second network as outlined in Sering et al. (2018). To place the performance of our model in perspective, Mozilla DeepSpeech, implementing (Hannun et al., 2014), correctly recognized the word tokens in our 20-hours of clean speech for only 6.28% of the cases.

However, substantially improved performance is obtained when the output layer of the network is redesigned. In NDL, the output layer represents a vector with units representing lexomes. For a given lexeme, one unit is on and all other units are off. This coding assumes that words’ meanings are orthogonal, which we know they are not: words are semantically similar to varying degrees. We therefore replaced these one-unit-hot encoded lexemic vectors of NDL by semantic vectors (Landauer et al., 1998) calculated from the tasa corpus. The network is now trained to approximate these real-valued vectors. To evaluate model performance, we compared the semantic vectors predicted by the model on the basis of the Frequency Band Summary Features derived from the speech wave with the gold standard semantic vectors derived from the tasa corpus, using the Pearson correlation. Word recognition was defined to be successful if the correlation of the predicted vector with the targeted gold vector was the highest of all the pairwise correlations of this predicted vector with any of the other gold semantic vectors. The proportion of correctly recognized words present in 20 hours of clean speech increased from 24.78% to 33.61%. For 55% of the speech tokens, the correlation with the target vector was among the top 5 highest correlations. Work is in progress testing this new model, linear discriminative learning, for greater volumes of data, for speech with noise, and for the level of generalization to unseen test data under cross validation.

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The major research question about morphological processing is the mechanism of access to multi-morphemic words: namely, whether they are accessed as a single unit (full-listing models; Butterworth, 1983), via decomposition into morphemes (Taft, Foster, 1975), or via a combination of the two mechanisms (e.g., dual-route model; Shreuder, Baayen, 1995). Various characteristics of multi-morphemic words can affect which mechanism is adopted: for example, more frequent words are more likely to be accessed as a single unit (Chialant & Caramazza, 1995). More recently, it has become a subject of research whether the mechanisms of morphological processing are also affected by individual characteristics of the language user, in addition to linguistic characteristics of the word. One of such individual factors is age.

Older age is correlated with increased accumulated exposure to word forms. Reifegerste et al. (2016) suggested that similarly to word frequency, greater individual linguistic exposure can lead to greater reliance on single-unit access to multi-morphemic words, rather than their decomposition. In their study, the hypothesis was tested in Dutch and German: the predicted lower role of decomposition in older adults was only found for German. The authors relate the discrepancy to greater morphological complexity of German than Dutch. The goal of our study is to replicate their experiment in an even more morphologically complex language (Russian), testing whether older Russian speakers also rely on morphological decomposition less than younger speakers. In addition, we extend the scope of Reifegerste et al. (2016) by adding another age group that has received little attention in studies of morphological processing: adolescents.

Our experiment replicates the experimental design of Reifegerste et al. (2016). The task is lexical decision. The stimuli are 112 Russian number-dominant nouns: i.e., nouns that are more frequently used in singular form (grandfather, bride) or in plural form (eye, sock). The two groups are balanced for length and overall lemma frequency. The stimuli are split into two experimental lists, so that each word is presented in both number forms (in different lists). Each list also includes 56 fillers and 168 pseudowords. Reaction times are analyzed. According to Reifegerste et al. (2016), single-unit access should be reflected in slower reaction times for non-dominant number forms; morphological decomposition should be reflected in slower reaction times for plural forms (regardless of number dominance); the dual-route model predicts an interaction between number dominance and number form (for singular-dominant nouns, reaction times should be faster for singular than plural forms, with no such difference for plural-dominant nouns).

To date, 29 younger (17-29 year-old) and 28 older (59-87 year-old) participants have been tested. In the current sample, word recognition is slower in older than younger adults, \( F(1,\ 55)=35.29, \ p<0.001 \), and for plural than singular word forms, \( F(1,\ 55)=16.64, \ p<0.001 \). The effect of number dominance and the interactions between age and number dominance or number form are not significant. These data suggest high reliance on morphological decomposition of multi-morphemic words in Russian across younger and older adults. This can be due to high morphological complexity of Russian: its system of noun inflection includes six cases in addition to two numbers, so morphological decomposition can be a more efficient mechanism even for older language users who have accumulated high exposure to word forms. However, these are preliminary findings from an incomplete participant sample. By the time of presentation, data collection will be completed and data from 40 younger adults, 40 older adults and 40 adolescents will be available.

References
Similar to the -er nominalizing suffix in English, Indonesian has two prefixes that create nouns from verbs and express a range of semantic functions (e.g., agent, instrument, patient). One prefix, henceforth pe-, is described as attaching to verbs with the prefix ber- by a process of affix substitution (e.g., pedagang ‘seller’ – berdagang ‘to sell’). A second prefix, henceforth peN- (N denotes nasal assimilation), attaches to verbs with the prefix meN- (e.g., pemandu ‘guide’ – memandu ‘to guide’). This prefix has several allomorphs (peng-, peny-, pe-, pen-, pem-, penge-) that mirror the allomorphy of the base verbs (meng-, meny-, me-, men-, mem-, menge-). The base words of meN- and ber- and their nominalizations can be verbs, nouns, and adjectives. Although several qualitative studies have addressed the formal regularities of these prefixes (Sneddon et al., 2010; Ramlan, 2009; Chaer, 2008), corpus based investigations are still in their infancy. In this study, we used distributional vector space models (Pantel, 2005) to clarify whether pe- and peN- have discriminable semantics.

We compiled a database from the corpus of written Indonesian in the Leipzig Corpora Collection (Goldhahn et al., 2012), analyzing words’ morphological structure with the MorphInd parser (Larasati et al., 2011) and checking results manually against the on-line version of a comprehensive dictionary of Indonesian (Alwi, 2012). Our database comprises a total of 84 nouns with pe- and 1362 nouns with peN-, as well as 4983 verbs with meN- and 2713 verbs with ber-, all of which satisfy the criterion of occurring at least 5 times. We used word2vec (Mikolov et al., 2013) to extract 200-dimension vector representations for these words. The cosine similarity measure was used to evaluate to what extent the semantic vectors of pairs of words are similar in meaning.

Wilcoxon test showed that the semantic similarities within the peN- words are greater than between pe- and peN- words. Furthermore, nouns with pe- are more similar to their base words compared to nouns with peN- (all p < 0.001). Semantics similarity rating on a 7-point Likert scale will be collected from native speakers of Indonesian to evaluate the quality of the present semantic vector. At the conference, we will report whether our experiment results are in agreement with our model predictions.

Massive Auditory Lexical Decision: Investigating Performance in Noisy Environments
Brant Harker, Michelle Leung, Filip Nenadić, Danielle Fonseca, Spenser Halfyard, Matthew Kelley, Pearl Lorentzen, Melina Sinclair & Benjamin V. Tucker

The MALD database (Massive Auditory Lexical Decision; Tucker et al., submitted) is a massive dataset investigating the processing of spoken word recognition, similarly to other large databases created in, e.g., Dutch (Ernestus & Cutler, 2015) or French (Ferrand et al., 2017), or for written word recognition (Balota, 2007; Keuleers, Diependaele, & Brysbaert, 2010). MALD also aims to encompass various listener (e.g., native language, dialect, age), item (e.g., part of speech, frequency, morphological complexity), and situational factors that may influence listener performance.

The present report discusses a version of the MALD database that investigates listener performance in an auditory lexical decision task in noisy, more ecologically valid circumstances. Data collection was conducted in the often crowded TELUS World of Science (TWOSE) on tablets, with multiple participants being tested at the same time. Most participants had varying levels of distractions while performing the experiment. A total of 533 employees, volunteers, and visitors at TWOSE participated in the experiment (age range 4 to 86 years old, M = 25.4, SD = 16.1; 51% female; 81.8% native speakers of English). The actual number of recruited participants was much larger, but not all gave or could give consent for their data to be stored, and some did not finish the experiment either due to technical issues or because they left. Stimuli were a randomly selected subset of 2000 words and 2000 pseudowords used in the MALD project, recorded by a single speaker. The stimuli were further randomly divided into 20 lists, each containing 100 words and 100 pseudowords, with no practice stimuli. Each participant was presented with a single list, with the entire experimental session usually lasting between five and ten minutes.

In comparison to participants tested in a laboratory setting, native listeners collected as part of TWOSE-MALD perform somewhat worse in terms of both accuracy (a decrease from 87% to 80%) and response latencies (an increase from 1017 ms to 1265 ms). This indicates that in a more ecologically valid sample and setting the time required to recognize a word is longer than what laboratory experiments may find. The relationship between the standard predictors and response latency remains the same, indicating that the process of spoken word recognition remains the same outside of the laboratory. Another interesting finding is that accuracy increases rapidly in the first 10 years and slowly plateaus, while response latencies rapidly decrease until participants reach their early twenties, after which a steady increase is noted as participants’ age increases.

References
When asked to indicate the referent of a novel word (like dax), monolingual children tend to pick unfamiliar objects (like a whisk), or assume mutual exclusivity (Markman, 1990). In contrast, on the same sort of disambiguation task, bilingual children often pick out more familiar objects than monolinguals, thereby allowing more synonyms. Researchers have proposed a number of possible explanations for bilingual children’s weaker use of mutual exclusivity, including flexibility in thinking (Davidson et al., 1997). The purpose of the present study was to test one possible explanation, proposed by Byers-Heinlein and Werker (2013). According to these researchers, because bilingual children’s mental lexicon includes different words that have the same referent (e.g., dog-perro), bilinguals are willing to accept novel synonyms. To test that explanation, we compared two groups of monolingual children, one whose language included many synonyms (Canadian French speakers) and one whose language did not (Canadian English speakers). Canadian French has many synonyms, even in child-directed speech (such as chaussure-soulier, pierre-roche). We predicted that French speaking children would demonstrate greater acceptance of novel synonyms than English speaking children. French speaking children between the ages of 3 and 5 years of age were recruited in the province of Quebec. An age-matched sample of English speaking children were recruited in Alberta. To test for the acceptance of synonyms, we asked children to indicate which picture (out of two) corresponded to a novel word. Children were given the choice of a familiar object (such as an apple or a car) and an unfamiliar object (an unnamable object for adults). The novel words followed the phonotactics of the target language (e.g., ripon in French and dax in English). Following this disambiguation task, we also tested children’s knowledge of labels for the familiar objects as well as the French speakers’ knowledge of synonyms. The dependent measure was the percentage of familiar objects chosen on the disambiguation task (or children’s willingness to accept novel synonyms). The results showed that the French speakers chose significantly fewer familiar objects than the English speakers. They strongly rejected accepting new synonyms. Both the French and English speaking children knew equivalent numbers of familiar words and the French speaking children demonstrated knowledge of a number of synonyms. Therefore, these results contradict the claim by Byers-Heinlein and Werker (2013). Thus, simply having synonyms in one’s mental lexicon does not mean greater acceptance of novel synonyms. The explanation for bilinguals’ weaker use of mutual exclusivity relative to monolinguals must therefore lie elsewhere.

References


significantly from the baseline, starting 265 ms after auditory target onset, and find no evidence for a difference between the noun and verb contexts in fixation proportions to balcony. This is incompatible with an inhibitory account of contextual constraint.

A second manipulation used an object picture for the competitor whose name could be a noun or a verb, but whose frequency was noun-skewed. Inclusion of such pictures also ensured motivation to look for a referent during verb contexts. Either constraint mechanism was expected to lead to increased fixations to the competitor in the noun relative to the verb context (as in previous designs), with the time window of such an increase indicating the timing of the category constraint.

We found a significant increase in fixations to plant during “She chose the platypus…” relative to “She chose to placate…”. This difference did not occur until 411 ms after auditory target onset, nearly 200 ms after significant cohort competition was evident, in contrast to previous studies showing immediate effects of context. For the most comparable design (Strand et al., 2017), this may be due to visual correlates of syntactic category allowing picture exclusion prior to target onset. We conclude that syntactic category features operate analogously to syntactic category effects of context. For the most comparable design (Strand et al., 2017), this may be due to visual correlates of syntactic category allowing picture exclusion prior to target onset. We conclude that syntactic category features operate analogously to bottom-up phonological input in their facilitatory contribution to auditory word recognition. Further investigation of the large variety in constraint timing across the literature is underway.

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**Emotion and Lexical Effects in an Auditory Lexical Decision Task with Vocal Affect**

Graham Tomkins Feeny, Juhani Jarvikivi & Benjamin V. Tucker

The expression and recognition of emotion is a vital aspect of the human experience; this is evident in social interactions, interpersonal relationships, and in the context of emotional and behavioral disorders (Webby, Symons, & Shores, 1995). Oft-used measures in linguistic tasks involve the dimensions of Valence, “the pleasantness of a stimulus” and Arousal, “the intensity of emotion provoked by a stimulus” (Warriner et al., 2013). A consistently observed effect of positive Valence exhibiting speeded response times in lexical decision tasks has been reported (e.g. Kuchinke et al. 2005; Schacht & Sommer, 2009; Kissler & Koessler, 2011). Effects of Arousal have been less consistent; however, some studies have found faster reaction times to high-Arousal stimuli regardless of Valence (e.g. Kousta, Vinson, & Vigliocca, 2009; Larsen, Mercer, & Balota, 2006) and to high-Arousal negative stimuli (Hofmann, Kuchinke, Tamm, Võ, & Jacobs, 2009). In addition, measures of Danger and Usefulness (Wurm & Vakoch, 2000) have both exhibited significant effects in lexical decision tasks resulting in speeded responses to both measures (e.g. Kryuchkova, Tucker, Wurm, & Baayen, 2012; Wurm, 2007; Wurm, Vakoch, Seaman, & Buchanan, 2004). These results have been posited in favor of a psychoevolutionary account of emotion processing, which contends that emotions evolved in a manner that aids in the organism’s survival (Plutchik, 1980). However, despite the apparent effect of emotion on lexical processing, few studies have explored the effects of processing auditory stimuli articulated with different emotional tones.

Sixty-six participants (23 males) performed an auditory lexical decision task with stimuli possessing vocal affect. A professional male actor spoke 280 English nouns and 270 nonce words in three emotional tones, Angry, Neutral, and Joyful, counter-balanced in three versions of the experiment. The Angry stimuli exhibited a more threatening tone, which we hypothesized would result in speeded reaction times according to the psychoevolutionary account. We further hypothesized that the aforementioned psychoevolutionary effects (i.e. Valence, Danger, Usefulness) would emerge as per past research; due to the inconsistent nature of Arousal effects, no specific hypothesis was formed with regard to this measure.

A linear mixed effects regression analysis with random intercepts for Subject and Stimulus was implemented using Laplace Approximation. Initially, all two-way interactions between all variables were included in the model. Following backfitting, the analysis uncovered statistically significant speeded reaction times for Angry stimuli as compared to Joyful (p < .001) and Neutral (p = 0.003) stimuli, and no statistically significant difference in reaction times between Joyful and Neutral stimuli (p = 0.49). We also observed a significant effect of Valence (p < .001), with more positive stimuli exhibiting speeded response times. We further observed effects of: Uniqueness point (p < .001), with stimuli with more latent uniqueness points exhibiting slowed response times; Frequency (p < .001), with more frequent nouns exhibiting speeded response times; and Trial (p < .001), with stimuli appearing later in the experiment exhibiting speeded response times. The analysis did not reveal any significant interactions between any of the variables and no significant effects of Arousal, Dominance, Danger, Usefulness, or other measures, such as Number of competitors, Age, Gender, and Speaker status (i.e. native/non-native English speaker).

The stimuli articulated in the Angry modality exhibited a more threatening tone, which we posited would result in a more robust reaction due to psychoevolutionary effects; the results support that hypothesis. This finding contributes to the growing body of evidence in favor of a psychoevolutionary account of emotion processing. The analysis also uncovered a statistically significant effect of positive Valence speeded responses that is consistently reported in lexical decision tasks and is often cited as evidence in favor of a psychoevolutionary theory of emotion (Kissler & Koessler, 2011). Interestingly, our results did not uncover any significant effects or interactions involving the Danger and Usefulness measures adopted from the framework established by Wurm and Vakoch (2000). One implication of this finding could be that the emotional tone was salient enough to diminish the lexical effect of Danger and Usefulness, which might suggest that emotional tone is a more salient cue than the semantics of the nouns with regard to the processing of emotion in the context of lexical processing.
MEG Responses Track Lexical Processing of Continuous Narrative Speech

Christian Brodbeck and Jonathan Z. Simon

Magnetoecephalography (MEG) and electroencephalography (EEG) measure millisecond to millisecond fluctuations in brain activity. This makes them suitable to unobtrusively assess neural processes that operate at the rate of phonemes during speech comprehension. Previous research has shown brain responses associated with lexical processing of isolated word stimuli (e.g. [1]). We show that a recently-developed analysis technique, modeling continuous MEG signals as response to ongoing properties of continuous speech stimuli [2], can be used to study lexical processing of uninterrupted narrative speech.

Source localized MEG responses to audiobook segments were modeled as linear filter response to multiple parallel predictor variables. Predictor variables were generated as continuous time series, aligned with the corresponding MEG recordings, reflecting acoustic and linguistic properties of the stimuli. To investigate lexical processing, predictor variables were generated with an impulse at each phoneme, with values based on the cohort model, reflecting cohort size, phoneme surprisal and cohort entropy. Results indicate significant left-lateralized effects of phoneme surprisal and cohort entropy. The response to phoneme surprisal was localized to auditory cortex with a main peak at ~ 110 ms, whereas cohort entropy was localized more ventrally, covering the superior temporal sulcus, with a main peak at ~ 130 ms. This difference in localization and timing is consistent with two stages during lexical processing. In particular, phoneme surprisal has been suggested to be a more local measure of how informative each phoneme is, whereas cohort entropy reflects the state of lexical activation through lexical competition [1]. The short latency of these peaks sug-
gests that acoustic information is rapidly used to constrain the word currently being heard. An additional response was found for word onsets (i.e., the initial phoneme of each word, compared to the subsequent phonemes) with a latency of ~110 ms, suggesting that listeners use cues available to anticipate upcoming word boundaries, rather than inferring them using post-boundary cues.

The framework established above was then applied to study the effect of selective attention during speech processing. Participants listened to an acoustic mixture of two speakers, attending to one and ignoring the other. Responses were modeled using both acoustic and lexical properties, of the attended as well as the unattended speech. Results indicate that while brain responses reflect acoustic properties of both speakers, responses reflecting lexical processing are found only for the attended speech. While previous research has shown that responses to semantic properties of words in unattended speech are suppressed [3], our results indicate that even processing of word forms is restricted to attended speech.

References

The present study is designed to better understand how participants from different language backgrounds perform in a meta-memory task involving word lists varying in common lexical features. Metamemory is a type of metacognition, in which a person can monitor their cognitive abilities and thought processes. A metamemory task includes the participant’s inference of their memory capacity and the task demands.

Specifically, participants were shown a series of words and placed a bet on each word based on how likely they think they would recall the word. After the words were presented, participants were asked to recall as many words as they could remember. We ran three conditions, each varying as a function of a specific lexical feature (imageability, polysemy, and valence). Each lexical feature condition consisted of equal number of words with high, medium, and low ratings of the feature while controlling for other common features (e.g. parts of speech, frequency). We hypothesized that participants will be able to remember more words as a function of these different lexical features. For example, participants will recall more positive or negative words as compared to neutral words or that they will recall words with more meaning senses than words with fewer meaning senses.

Our participants sample consisted of English monolinguals, English dominant bilinguals, or English non-dominant bilinguals based on their responses to a language acquisition questionnaire. It is thought that bilinguals have separate, though interconnected, storage systems for each language they speak (Paivio, 2014; Jared et al, 2013). Thus, an additional aim of our study is to investigate the bilingual dual-coding theory by testing whether bilingual participants recall more words that are easily represented visually as compared to abstract words than English monolinguals.

Preliminary findings from over 70 participants in the valence condition show that consistent with our hypothesis, college students chose to bet higher on negative and positive words compared to neutral words, and they also recall more negative and positive words. However, English non-dominant bilinguals chose to bet significantly more points on positive and neutral words than their peers did, indicating that they may be differently sensitive to the valence level of each word.
Platform Session 1.3
Chair: Victor Kuperman

16:20—16:40
How Morphological Structure Affects Phonetic Encoding: Modeling the Duration of Morphemic and Non-morphemic S Fabian Tomaszek, Ingo Plag, Harald Baayen & Mirjam Ernestus

16:40—17:00
Learning Case and Number Inflection in Three Typologically Distinct Artificial Languages Vedran Dronjic, Daniel Keller, Maren Greve, Maria Kostromitina & Tiana Covic

17:00—17:20
Auditory Morphological Priming of Semantically Transparent and Opaque Dutch Prefixed Verbs Ava Creemers, Amy Goodwin Davies & Robert J. Wilder

17:20—17:40
Compounds and Phrases from a Cognitive Angle: Are they Learned Differently? Marcel Schlechtweg
A number of recent studies have investigated the role of morphological structure in phonetic implementation. This is an important field of research from the perspective of the mental lexicon, since the results pose a challenge for traditional models of phonology-morphology interaction and of speech production which postulate that phonetic processing does not have access to morphological information (e.g. Chomsky and Halle 1968, Kiparsky 1982, Levelt and Wheeldon 1994, Levelt et al. 1999).

Homophonous affixes have played a prominent role in this debate. Plag et al. (2015) investigated multi-functional word-final [s] and [z] (‘S’) in conversational North American English, using a small sample from the Buckeye Corpus (Pitt et al., 2007) with manual phonetic annotation. Plag et al.’s data showed robust differences in the acoustic durations of seven kinds of final S (non-morphemic, plural, third person singular, genitive, genitive plural, cliticized has, and cliticized is). Non-morphemic S is the longest, the suffixes are shorter than non-morphemic final S, and the clitics are shortest. Basically the same patterns of durational differences hold for New Zealand English, as shown in a study based on a very large sample with automatic phonetic annotation from the Quakebox Corpus (Zimmermann 2016). Seyfarth et al. (2017) also find differences in stem and suffix durations in English inflected words (e.g. frees, laps, swayed) compared to their simplex phonologically homophonous counterparts (e.g. freeze, lapse, sue). In this paper we tackle the question of how the differences between the different types of word-final S observed in the literature can be explained. Plag et al. (2015) discuss a number of possible explanations for their findings, none of them being satisfactory, Seyfarth et al. attribute the effects they found to paradigm uniformity.

We first replicate the results by Plag et al. (2015), using the full Buckeye Corpus with its automatic segmentations. We then model the duration of S using a Naive Discriminative Learning (NDL) Model. NDL is an associative theory of learning that is well established in cognitive psychology (e.g. Rescorla 1988, Pearce and Bouton 2001). More recently, the approach has been used to model different kinds of phonological, morphological, and syntactic phenomena (e.g. Arnon and Ramscar 2012, Baayen et al. 2011, 2013, 2015, Blevins et al. 2015, Ramscar et al. 2013, Arnold et al. 2017).

NDL is a two-layer model of learning model that computes association weights between cues and outcomes. These weights can be conceptualized as the extent to which a particular form can be expected to be associated with a particular meaning in the mind of the average speaker.

We show that the association weights between phonological and semantic information in the context of a given word form as cues, and the suffixal meaning as outcomes, are highly predictive of acoustic duration. The more activation for a certain outcome, the longer the duration of the S. Our results are in line with the Paradigmatic Signal Enhancement Hypothesis (Kuperman et al., 2007) which states that the more probable a variant is in a given paradigm, the longer it will be articulated (see also Ernestus and Baayen 2006).

The results have important implications for theories of phonology-morphology interaction and for models of language production, as they pave the way towards an integration of morphological effects on what has been conceived as ‘post-lexical’ processes.

References


We investigated how adult native English speakers learn case and number morphology in 3 typologically distinct artificial languages (isolating, agglutinative, fusional). We ask (1) if language type affects ease of learning and (2) which cognitive abilities among a) declarative memory (paired associates task), b) procedural memory (serial response time task), c) phonological short-term memory (digits forward and backward tasks), d) fluid and crystallized intelligence (KBIT-2) predict learning in each language type. The prime candidates for influencing L2 inflectional learning are: 1) salience (Ellis, 2006); 2) complexity of form-meaning mappings (DeKeyser, 2005); 3) L1-L2 transfer (Luk & Shirai, 2009; Tolentino & Tokowicz, 2011); and 4) individual differences in procedural, declarative, and working memory. It is unknown how these map onto specific L1-L2 pairings to impede or facilitate learning. Learners with better declarative and working memory fare better at the initial stages of L2 syntactic learning, while procedural memory is a predictor of success thereafter (Hamrick, 2015; Morgan-Short et al., 2014, 2015). These findings have not yet been extended to inflection, which is likely to share cognitive resources with syntax (Bozic & Marslen-Wilson, 2010; Paradis, 2009; Ullman, 2004). On 4 separate days (with intervening days), we trained 63 adult English speakers (90 by summer of 2018) to match spoken sentences and visual scenes in 1 of 3 artificial languages consisting of 1 existential verb, 8 noun roots, and 4 functors (suffixes or free roots: singular, plural, inessive, superessive). Examples appear in the table (suffixes separated by hyphens):

Language Meaning: “There is a spoon on a container.” “There is a spoon on containers.”
Frazeo-I (isolating) Asa i gum sa i dus.
“EX SG spoon SUPE SG container” Asa i gum sa o dus.
“EX PL spoon SUPE PL container”
Frazeo-A (agglutinative) Asa gum-i dus-i sa.
“EX spoon-SG container-PL SUPE”
Frazeo-F (fusional) Asa gum-i dus-esa.
“EX spoon-SG container-PL SUPE”

We measured learning with a task in which spoken sentences were matched to 1 of 4 similar visual scenes (familiar from training or novel). Response times were more consistent for the agglutinative type relative to isolating and fusional, indicating greater automaticity. Linear mixed effects modelling showed that responses were slower for the fusional type for novel scenes relative to familiar scenes. Response accuracy was modelled using mixed effects binomial logistic regression. For novel scenes, accuracy was higher for the agglutinative than the isolating or fusional types. Cognitive abilities made different contributions for the types: Backward digit span predicted accuracy in the agglutinative type (underscoring the importance of element ordering), procedural memory and crystallized and fluid intelligence predicted accuracy in the fusional type; only crystallized intelligence predicted accuracy in the isolating type. Agglutinative morphology was easiest, followed by isolating. This is striking as: 1) the isolating language was head-initial (like English), while the agglutinative one was head-final, implying that head directionality may not be crucial in inflectional learning; and 2) the isolating language featured free roots only (hypothesized easier due to salience), but findings suggest a processing cost for lexical functors that overshadows salience. Additionally, the opaque, complex form-meaning mappings make fusional morphology the most challenging. For the average English speaker, fused inflection may be too complex to learn explicitly. While strong problem-solvers may still use this approach, others may need to rely on procedural learning. Our results shed new light on the intricate interplay of factors involved in inflectional learning.

References


Auditory Morphological Priming of Semantically Transparent and Opaque Dutch Prefixed Verbs

Ava Creemers, Amy Goodwin Davies & Robert J. Wilder

We provide novel psycholinguistic data which suggest that morphological structure is explicitly represented in memory for both transparent and opaque complex words (cf., Stockall and Marantz 2006; Taft 2004), contra previous claims that morphology should be attributed to mere interactions between form and meaning (e.g., Baayen et al. 2011; Gonnerman et al. 2007). The extent to which morphemes are semantically compositional has been argued to influence morphological decomposition in French and English in overt priming paradigms (Feldman et al. 2004; Longtin et al. 2003; Marslen-Wilson et al. 1994; Rastle et al. 2000), but not in German (Smolka et al. 2014) and Semitic languages (Boudelaa and Marslen-Wilson 2015; Frost et al. 1997). This paper investigates the role of semantic transparency in the lexical representation of morphologically complex verbs in Dutch, and shows that both semantically opaque and transparent words prime their stem.

Methods

We conducted two auditory priming experiments with continuous lexical decision. Participants were native speakers of Dutch (32 in Exp1, 40 in Exp2). In Exp1, prime-target pairs were manipulated with respect to their morphological, semantic, and phonological relatedness: Targets were prefixed verbs (e.g. *bieden*, ‘offer’), which were primed by prefixed and particle verbs that were either both morphologically and semantically (MS) related (*aan-bieden*, ‘offer’), only morphologically (M) related (*ver-bieden*, ‘forbid’), phonologically (Ph) related (*be-spieiden*, ‘spy’), or unrelated (C: *op-jagen*, ‘hurry, rush’). Critical items were distributed over four lists. Exp2, in addition to the MS, M, and unrelated C pairs, also included purely semantically (S) related primes (e.g., *ver-kenen*, ‘offer, grant’), and manipulated the number of intervening items between prime and target (using a 0-lag and 5-lag) to further tease apart semantic and morphological effects.

Results

Linear mixed-effects models were used to analyze log-transformed accurate response times (RTs) to targets. We included Prime Condition, Distance (Exp2), Trial, ISI, Prime/Target Frequency, and Target Duration as fixed effects, and random intercepts for subjects, primes, and targets. In Exp1, both MS and M complex verbs significantly facilitate lexical decision of their stem compared to C (MS: β = -0.12, p < 0.001; M: β = -0.10, p < 0.001), while the Ph condition does not (p = 0.102). No significant difference between MS and M (p = 0.111) is found, while Ph shows significantly longer RTs compared to M (β = 0.08, p < 0.001), indicating that priming in the M condition is distinct from a mere Ph effect. For Exp2, the results at a 0-lag reveal significant priming effects for the MS and M conditions (MS: β = -0.06, p < 0.001; M: β = -0.06, p < 0.001), but no priming effect is found for S (p = 0.365). Also, no difference between M and MS (p = 0.709) is found, while S and MS do significantly differ (β = 0.05, p < 0.001). This shows that the priming effects in the MS condition are significantly bigger than pure S priming. While we expected to find a gradual drop-off in the priming effects, analysis of the results at a 5-lag shows that none of the effects for prime condition are significant (MS: p = 0.536; M: p = 0.616; S: p = 0.334).

Conclusions In line with the aforementioned German results, our results show that morphological priming is independent of semantic transparency in Dutch complex verbs. We also show that M effects are distinct from Ph effects, and that MS effects are distinct from S effects. This shows that semantic relatedness is not a precondition for the occurrence of morphological priming, and that morphological identity is distinct from mere semantic and phonological similarity. We believe that cross-linguistic differences in the extent to which semantic compositionality influences morphological priming should be attributed to the way the M condition is defined across studies. While the Dutch, German, and Semitic stimuli were real morphological derivations of their stem (as shown by for instance shared irregular allomorphy), ‘M’ words like *corne√-corn* in English were only pseudo-complex and not truly morphologically related.

References


Compounds and Phrases from a Cognitive Angle: Are they Learned Differently?

Marcel Schlechtweg

The formal, functional, and semantic demarcation between compounds and phrases has been hotly debated over the last decades (see, e.g., Lieber & Stekauer 2009). Much less is known, however, about the cognitive distinction between the two categories. Although compounds have been extensively analyzed from a psycholinguistic perspective (see, among many others, Ji, Gagné & Spalding 2011; Libben, Gibson, Yoon & Sandra 2003; Zwitserlood 1994), the cognitive distinction between compounds and phrases has been the focus of only a handful of studies and, if examined, was sometimes confounded with other factors such as lexicalization or orthography (see, e.g., Kotowski, Böer & Härtl 2014; McCauley, Hestvik & Vogel 2012). The present study aims at investigating the cognitive characteristics of adjective-noun (AN) compounds and phrases within a single language, namely German, by eliminating problems encountered in earlier research. Compounds and phrases are defined on a morphosyntactic basis (see, e.g., Booij 2010; Zwicky 1986), i.e., while the adjective of a phrase such as schwerer Strumpf ‘heavy sock’ is inflected for certain grammatical properties such as number, the adjective in a compound such as Schwersocke ‘heavy_sock’ attaches to the noun without any adjectival/inflectional suffix. Native speakers of German were exposed to non-lexicalized/invented and spoken compounds and phrases only. Both compounds and phrases were examined with both initial and non-initial prosodic prominence in order to control the item set for this factor as well. Note that compounds usually have initial prominence but phrases favor non-initial prominence. Using the variables CONSTRUCTION TYPE (within-subject/item; levels: compound, phrase) and PROSODIC PROMINENCE (within-subject/item, levels: initial versus non-initial), 24 quadruplets were created and compared across the four conditions in a reaction-time/accuracy experiment (DAY was the third independent variable, see below). The same adjectives occurred in compounds and phrases. Since the adjectives are disyllabic in phrases (monosyllabic stem + inflectional suffix) but monosyllabic in compounds, the nouns of the phrases were monosyllabic but those of the compounds were disyllabic, creating both trisyllabic phrases and trisyllabic compounds. The nouns appearing in the phrases (e.g., Strumpf ‘sock’, Schwamm ‘sponge’) were semantically comparable to the compound heads (e.g., Socke ‘sock’, Bürste ‘brush’). The items and sound files were controlled for several potentially confounding variables (e.g., construction and constituent frequencies, number of syllables and phones, duration, nominal semantics). 24 subjects participated on three days (days 1, 4, and 8) and, on each day, were asked to memorize/learn AN compounds and phrases that they heard (the same constructions on each day), before being asked to react to constructions that they heard with the buttons “Yes” if they heard a memorized item and “No” if they heard a non-memorized one. Results show a clear main effect of CONSTRUCTION TYPE and PROSODIC PROMINENCE: Compounds were responded to more efficiently than phrases and items with non-initial prominence more efficiently than constructions with initial prominence. While the second effect is interpreted as a mere frequency effect (non-initial prominence is overall more frequent than initial prominence in German AN constructions), the first is considered to support the idea that compounds are processed and stored more efficiently than phrases. Crucially, not only compounds with typical compound prosody (initial prominence) were memorized more efficiently than phrases with atypical prosody (initial prominence), but also compounds with atypical prosody (non-initial prominence) were memorized more efficiently than phrases with typical prosody (non-initial prominence). Overall, the paper provides evidence for the idea that compounds and phrases are treated differently in the mental lexicon.

References
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### Platform Session 2.1

**Chair:** Ingo Plag

**08:40—09.00**

**Individual Variability in Processing Words in L1 and L2**

Victor Kuperman, Raymond Bertram, Charlotte Erlinghagen & Aleksandra Pieczykolan

**09:00—09:20**

**Phonemic and Semantic Verbal Fluency in Bilingual Lakota-English Speakers**

Larissa Jordan & Karen Bryant

**09:20—09:40**

**Lexical Organization in L2 Arabic: A Masked Priming Study**

Rebecca Foote, Mousa Qasem & Emma Trentman

**09:40—10:00**

**Comparing L1 and L2 Processing of Novel Lexical Items: An Eye-tracking Study**

Anna Tsiola & Kiel Christianson
We examine the role of spelling errors on recognition of correctly spelled English words in L1 readers of English and Finnish and German L2 readers of English, using eye-tracking. Recent work (Rahmanian & Kuperman, 2017) suggests that spelling errors may be both the outcome of weak orthographic representations and their partial cause. Encountering spelling alternatives (e.g., innocent 69% of the time vs innocent 31% of the time) leads to weakening of associations between either orthographic form and the sound and meaning of the word, in line with predictions of learning theories (Baayen et al., 2011) and the Lexical Quality hypothesis (Perfetti, 2007). Thus, higher spelling entropy (a measure of uncertainty as to which orthographic alternative to choose for a word) have been shown to come with longer latencies of lexical decision and eye fixations (Rahmanian & Kuperman, 2017). Prior work has hypothesized the modulating role of individual English proficiency in the effect of spelling entropy on recognition times. Two logical possibilities exist. On the one hand, more proficient readers are the ones with more stable orthographic representations, so arguably they are more capable of mitigating the harmful role of spelling errors when processing correctly spelled words. On the other hand, more proficient readers tend to have more exposure to the written input, and are likely to encounter more cases of spelling variability, including errors: thus their orthographic representations may be more volatile than that in less proficient readers with limited input. Prior work on English has failed to reveal any entropy by skill interactions.

The present study presents parallel eye-tracking experiments conducted with 33 Finnish and 28 German L2 university-level speakers of English, who were exposed to the same stimuli as used in Rahmanian and Kuperman (2017). The central questions were (a) whether L2 learners of English will be sensitive to orthographic alternations in the written English input, and (b) whether the entropy x skill interaction exists and what direction it takes. The stimuli were 70 English sentences, each containing a correctly spelled word (e.g., commit) that also occurs with a spelling error (comit): words were selected to represent a range of spelling entropy. The task was sentence reading for comprehension with eye-tracking: participants also completed a range of English proficiency tests.

Eye-tracking data were collected using Eye Link 1000 in a Finnish and a German university, and analyzed using generalized additive models. Data patterns answered both questions in the positive. Both L2 cohorts revealed a non-linear positive effect of spelling entropy on reading times, nearly identical in shape to that previously observed in L1 readers (Figure 1). Both L2 cohorts also showed a critical entropy by skill interaction: readers with a higher English proficiency were affected by entropy to a smaller extent than less proficient ones (Figure 2). These findings clearly point to an important role of individual variability: higher levels of English proficiency come with crisper orthographic representations and attenuate the harmful effect of spelling variability on both word learning and word recognition. The present data patterns have implications both for theories of statistical word learning and educational practices of instruction in literacy and reading. Unification of spelling conventions is beneficial both for L1 and L2 learners of a language.

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### Phonemic and Semantic Verbal Fluency in Bilingual Lakota-English Speakers

**Larissa Jordan & Karen Bryant**

Phonemic and semantic verbal fluency (VF) contribute to diagnosing individuals with suspected neurological disorders as well as to our theoretical understanding of the lexicon. Higher education and younger age have been shown to improve semantic and phonemic VF scores (Costa et al., 2014). Bilingualism is thought to also affect these tasks differently with some studies finding an improvement on scores (Portocarrero, Burright, & Donovich, 2007), others finding a reduction in scores (Sandoval, Gollan, Ferreira, & Salmon, 2010), and still others finding no differences in scores when compared to monolingual speakers (Luo, Luk, Bialystok, 2010). Normative data which accounts for education, age, and languages spoken is crucial for accurate diagnosis of cognitive impairments.

The Lakota people of western South Dakota are bilingual Lakota and English speakers, yet no normative data on VF currently exists, despite the task findings being considered during medical evaluations. This study was conducted to determine:

1. if Lakota-English speakers provide a greater number of words when completing VF in English or in Lakota;
2. if Lakota-English speakers provide greater than, fewer than, or the same number of words as monolingual English speakers on phonemic and semantic VF;
3. if Lakota-English speakers provide greater than, fewer than, or the same number of clusters and switches as monolingual English speakers on phonemic and semantic VF.

Forty-three bilingual Lakota-English speakers and fifty-three monolingual English speakers completed a semantic (animal) VF task and a phonemic (words beginning with P) VF task. Lakota-English speakers completed both tasks in English and then also in Lakota. Words beginning with P were chosen based on the recommendation of a Lakota translator because the typical F, A, or S words were not appropriate in Lakota. Instructions for the tasks were based on the Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005) and the Cognitive Linguistic Quick Test (CLQT; Helm-Estabrooks, 2001).

Results showed Lakota-English speakers named a greater number of words in English versus Lakota during both phonemic (t (42) = 6.58, p = < .001) and semantic (t (42) = 8.66, p < .001)
tasks. When completing the phonemic task in English, Lakota-English speakers named fewer words than monolingual English speakers (t (94) = 2.18, p = .032), but the same number of words as monolingual English speakers during the semantic task (t (74.26) = .199, p = .843). The cluster and switches analyses are currently in process.

These findings show bilingual Lakota-English speakers’ VF results are not always comparable to monolingual English normative data, but it depends on the precise task. When evaluating Lakota-English speakers with suspected neurological impairments, standardized assessments which utilize phonemic VF should be used with caution. However, our study suggests those which use semantic animal VF are appropriate for comparison with monolingual English normative data.

References

Lexical Organization in L2 Arabic: A Masked Priming Study
Rebecca Foote, Mousa Qasem & Emma Trentman

Research indicates that the way words are organized in the mental lexicon differs in native speakers of Arabic and native speakers of English. Specifically, while words are organized at least in part according to orthographic or phonological form similarity in native English speakers (e.g., cart-carp), they are predominantly organized according to morphological similarity in native speakers of Semitic languages (e.g., happy-happiness; Frost, Forster, & Deutsch, 1997; Frost, Kugler, Deutsch, & Forster, 2005). This means that when native speakers of Arabic encounter a word, that word and other words that are related morphologically become activated; words that are related only in form are not activated. The goal of the current study is to determine whether learners of Arabic as a second language (L2) with English as their first language are able to develop native-like patterns of lexical activation in Arabic, demonstrating morphological but not form-based activation. Some previous studies with L2 learners of other languages suggest that they may be less sensitive to morphological than native speakers, but more sensitive to orthographic form (e.g., Clahsen, Felser, Neubauer, Sato, & Silva, 2010; Heyer & Clahsen, 2015). However, one recent study provides evidence that L2 learners of Arabic, like native speakers, do show morphological but not form activation (Freynek, Gor, & O’Rourke, 2017). Nevertheless, this study employed a cross-modal priming task, in which both prime and target were consciously perceived, while much of the research that shows differences in natives and L2 learners has used masked priming tasks which are thought to get at earlier, subconscious processes of lexical access. In order to confirm nativelike activation patterns at these earlier stages of lexical access, the present study employs masked priming.

Participants (native speakers of Arabic, intermediate, and advanced proficiency learners) completed one of two masked priming, lexical decision tasks. Response times were measured to target words preceded by primes presented for 43 (Experiment 1) or 60 (Experiment 2) milliseconds that were orthographically-1 or morphologically2-related, identical3 or unrelated4 to target words. Experiment 1 results with 75 participants (25 per group) showed first, that intermediate proficiency learners were not able to process the prime at such a brief duration. Second, while native speakers of Arabic showed faster response times to targets preceded by identical and morphologically-related primes, they were not faster to respond to targets preceded by orthographically-related primes, replicating previous research. As for the advanced learners of Arabic, like the native speakers, they responded more quickly to targets preceded by identical and morphologically-related primes. However, they also responded more quickly to targets preceded by orthographically-related primes. In order to examine whether a longer presentation would allow intermediate proficiency learners to process primes, Experiment 2 used a 60 millisecond prime duration. Results with 40 participants (25 natives, 15 intermediate learners) revealed that native speakers patterned as they did in the first experiment. They also indicated that intermediate learners, who were able to process the primes with the longer presentation time, patterned like the advanced learners from Experiment 1. These results suggest that, while the L2 learners may be showing sensitivity to morphological structure in Arabic, they are also demonstrating a nonnative-like sensitivity to orthographic form. This implies that these learners have not entirely reorganized their L2 lexicon, but instead may be using a hybrid of their L1 and L2 systems.
Studies investigating bilinguals suggest that L2 processing is generally slower (e.g., Moreno & Kutas, 2005) and shows increased difficulty with semantic integration (e.g., Moreno et al., 2008). Chaffin et al. (2001) showed that L1 speakers can establish the meaning of novel items from context, and Pellicer-Sánchez (2016) found a slower rate of learning new items for L2 than for L1, but without discussing potential sources of this difference. In general, little research has compared L1 and L2 processing of new lexical items and the process of deriving their meaning from context. The present study asks whether L1 and L2 speakers differ (1) in the way they process novel items, (2) attention to contextual cues to derive their meaning, and (3) how many items they can subsequently recall. 42 L1-English and 32 (final N=40) L1-Chinese, advanced L2-English speakers participated in an eye-tracking experiment inducing incidental learning conditions, followed by a receptive vocabulary post-test. Each stimulus contained 2 sentences presented together in separate lines; Sentence 1 contained the target word (novel/familiar) and an informative/uninformative context (resulting in 4 conditions, 2x2 repeated design in each speaker group). Sentence 2 included a repetition of the target word and its hypernym. Below is a stimulus example from the novel word/informative context condition:

He picked up the barhepword1 from the floor to play some music context and frowned. He had realized that the barhepword2 is a difficult instrument-thynym to learn by yourself.

Early (first fixation duration, gaze duration) and late (total time, regression path duration) eye-tracking measures on each of the 4 interest areas (bolded above) were analyzed with mixed effects models to examine processes of lexical access and semantic integration. Both groups had inflated reading times at novel words, and at contexts that were informative and thematically linked to the preceding target word. Although the L2 participants were consistently slower in reading across the sentences than L1, the two groups had similar patterns in measures indexing processes of lexical identification, lexical access, and semantic integration. In addition, reading times for novel items from sentence 1 to sentence 2 were reduced at the same rate of 30% for both groups, contra Pellicer-Sanchez (2016). The groups only diverged in regression path durations at the interest area “context,” which indexes integration difficulty: L2 speakers showed more difficulty with informative contexts for both familiar and novel words, whereas the L1 showed this difficulty only for familiar words. Considering that there was a documented integration cost with familiar words, the L1 group’s pattern suggests that they did not attempt semantic integration when the word was novel, perhaps due to difference between groups in orientations to the task. The language of the experiment (L1 or L2) could be mediating how deeply participants processed the stimuli. Finally, L1 and L2 speakers retained a similar number of items in the post-test (L1 M=1.94, L2 M=1.57, t(1412.3) = 1.41, p = 0.15).

These findings suggest (1) that L2 processing of novel items patterns in the same way as L1, questioning the view of L2 speakers as inherently ‘deficient’, and (2) the group differences in the context region indicate that they approach the task as incidental vs intentional learning. Preliminary data from a follow-up think-aloud experiment do in fact suggest group differences in depth of processing. In sum, the process of deriving the meaning of a new word from context and adding it to the mental lexicon does not differ substantially between L1 and L2 speakers, suggesting alternate sources of the quantitative differences commonly observed in the literature.

References

Anna Tsiola & Kiel Christianson
Comparing L1 and L2 Processing of Novel Lexical Items: An Eye-tracking Study
Anna Tsiola & Kiel Christianson

Poster Session P.2 And Refreshments
10:00-11:40

1. Context and Literality in L1 and L2 Idiom Processing: A Self-paced Reading Study
   Sara Beck & Andrea Weber

2. Intentional and Incidental Encoding of Associative Information
   Brette Lansue, Daniela Wong Gonzalez & Lori Buchanan

3. Morphological Processing in Aging Bilinguals: Evidence from Inflectional and Derivational Priming
   Jana Reifegerste, Kirill Elin & Harald Clahsen

4. Pronoun Interpretation Problem in Dutch-German Bilingual Children: On the Role of Language Dominance and Language Influence
   Regina Hert, Anike van Oosterom, Petra Hendriks & Esther Ruigendijk

5. On the Semantics of Non-words and their Lexical Categories
   Giovanni Cassani, Yu-Ying Chuang & Harald Baayen

6. Is Executive Function Associated with Vocabularly Naming Miscues for Preschool Children?
   Trelani Milburn, Anka Chan, Leah Auch & Bryan Legrow

7. How Does Syntactic Form and Conventionality Affect Metaphor Production?
   Faria Sana, Juana Park, J. Claire Burry, Christina Gagne & Thomas Spalding

8. Computational Modeling of an Auditory Lexical Decision Task using jTRACE
   Filip Nenadić & Benjamin V. Tucker

   Hilary Wynne & Aditi Lahiri

10. The Time-based Demands of Visualization
    Simritpal K. Malhi, Cassidy Kost & Lori Buchanan

11. Letter Connectedness and Arabic Visual Word Recognition
    Ibrahim Alkhoury & Jeffrey Witzel

12. Word Neighborhood Influences Lexical Access and Benefits L2 Students (Portuguese) in a L1 (Spanish) Context
    Alma Luz Rodriguez Lázaro

13. Following the Path of Lexical Access in Bilinguals (Spanish-English) through Eyetracking
    Alma Luz Rodriguez Lázaro & Natalia Arias-Trejo

    Gaisha Oralova & Victor Kuperman

15. Variability and Consistency in L2 Morphology: An EEG Production Study
    Anna Jessen, Joao Veríssimo & Harald Clahsen

16. The Structure of Persian Compound Words in the Mental Lexicon
    Narcisse Torshizi & Elisabeta Service

17. Diachronic and Qualitative Analysis of English Hyphenated Compounds in the Last Two Hundred Years
    Kun Sun

18. The Kamin Blocking Effect in Speech Acquisition: Non-native Acoustic Cue Learning is Blocked by Already-learned Cues
    Jessie S. Nixon

19. Investigating 'Nativeness': L1 Morphological Processing in an L2-dominant Environment
    Sandra Kotzor, Swetlana Schuster & Aditi Lahiri

20. Effects of Practice on Anticipatory Coarticulation in Suffixed Verbs
    Fabian Tomaschek, Benjamin V. Tucker & Harald Baayen

21. Long-term Dependencies in Plains Cree
    Atticus Harrigan, Antti Arppe & Katherine Schmirler

22. Grammatical Processing in a Heritage Language: Evidence from Morphological Decomposition of Vietnamese Compounds
    Juliet Huynh & Naoko Witzel

23. L2 Development of the Russian Case System
    Natalia Cherepovskaia & Natalia Slioussar
Intentional and Incidental Encoding of Associative Information

Brette Lansue, Daniela Wong Gonzalez & Lori Buchanan

Associative memory is critical for encoding new concepts and retrieving stored information (Hockley, Ahmad, & Nicholson, 2016). A few studies have found that memory for associations can occur under both intentional and incidental encoding conditions (Bancroft, Hockley & Farquhar, 2013; Hockley et al., 2016). The directed forgetting procedure has been used to examine these two types of encoding (Johnson, 1994). In this procedure, study items are presented and then followed by a cue signaling participants to either remember the item (R-cue) or forget the item (F-cue). This manipulation is thought to distin-

Context and Literality in L1 and L2 Idiom Processing: A Self-paced Reading Study

Sara Beck & Andrea Weber

Idioms have a figurative meaning different than the compositional meaning of their individual constituents. For example, break the ice means, figuratively, to start conversation in a new social situation, and, as a high-literality idiom, it can also be readily interpreted via literal composition. Current research on native (L1) speakers has shown that context can impact access to the figurative meaning, but not necessarily the literal meaning (e.g., Holsinger & Kaiser, 2013) and has even suggested that literal composition might be hindered in the presence of figurative contexts (e.g., Canal et al., 2017). Furthermore, idioms vary in their potential for a literal interpretation. A low-literality idiom such as lose one’s cool, meaning to lose control of one’s emotions, is difficult to interpret literally without any context. For these idioms, literal meaning is less necessary, and literal composition might become superfluous more quickly (e.g., Titone & Conine, 1994). These expectations are even less clear for non-native (L2) speakers. L2 research maintains that literal meaning may play an even more prominent role in processing, and context can improve access to figurative meaning late in processing (e.g., Cieślicka & Heredia, 2011). For L2 speakers, this literal dominance further complicates processing questions considering either their (in)abilities to integrate context in a native-like manner or their reliance on it as a processing strategy. A clear comparison of the impact of context on both interpretation types, idiom types, and speaker groups is still lacking. Our study looks to add to research in this area by asking: How does biasing context impact access to literal and figurative meaning in high- and low-literality idioms for both L1 and L2 readers, and what happens in online processing when contextual expectations are met or turn out to be misleading?

We conducted a phrase-by-phrase self-paced reading study in English on native (US) and highly-proficient non-native (German) speakers on sentences containing high- and low-literality idioms. Idioms were embedded in literal and figurative contexts and followed by prepositional phrases that were either congruent or incongruent with these expectations (Table 1). Norming studies were conducted on experimental items and were included in the analyses.

High- Literality The new schoolboy, who didn’t know anyone in his class, just wanted to break the ice with his peers ...

The chilly Eskimo, who was eager to catch some fish, on the lake

Low- Literality The emotional writer, who often started political debates, didn’t want to lose his cool in his anger ...

The overheated runner, who was resting under a tree, from the shade

Table 1. Figurative contexts/endings (DARK), Literal contexts/endings (LIGHT).

Using linear mixed-effects models, we analyzed several regions of interest and found that, on the resolution (with his peers/on the lake), literal endings were read more quickly than non-literal endings across idiom-types and readers. The following region showed faster reading times for figurative endings overall. However, interactions showed that, unlike in previous studies, congruent contexts and endings improve reading times following high-literality idioms for both literal and figurative interpretations, while unambiguous idioms show advantages for figurative resolutions regardless of context. No differences were found between L1 and L2 readers. These findings provide further evidence for immediate literal processing. However, as it unfolds in real-time, both reader groups integrate context only where there is a high potential for ambiguity; these composition mechanisms can be hindered in cases where the likelihood for ambiguity is less present. Furthermore, it seems that highly proficient L2 readers are just as able to integrate contextual cues during reading or even ignore them where experience deems it unnecessary.

References


guish between intentional and incidental encoding whereby the R-cue elicits intentional encoding and the F-cue evokes incidental encoding. This procedure has revealed a directed forgetting effect in associative memory tasks such that information followed by R-cues is better remembered than information followed by F-cues (Bancroft et al., 2013; Hockley et al., 2016). Even the information followed by F-cues elicited higher than chance recognition rates suggesting that associative information can be encoded incidentally. However, a recent study that examined the effects of pre-existing semantic associations and elaborative encoding on intentional and incidental associative memory, while controlling for word frequency, found no directed forgetting effect (Wong Gonzalez, Lansue, & Buchanan, 2017).

The current study aimed to discern a cause for this discrepancy by combining the elaborate encoding manipulation of Wong Gonzalez et al. (2017) and the stimulus set of Hockley et al. (2016). We present data from a task in which participants studied a list of word pairs under elaborative or non-elaborative encoding conditions. The word pairs consisted of words with a pre-existing association (compound word constituents) or words that were semantically unrelated (non-compound words). In psycholinguistics terms we compare memory performance between lexicalized and non-lexicalized word associations. We used the directed forgetting procedure; word pairs were either followed by an R-cue signaling participants to remember the item, or an F-cue signaling them to forget the item. Memory was measured using a yes/no recognition memory task.

Accuracy was greater for compound (lexicalized) pairs than noncompound (non-lexicalized) pairs. A directed forgetting effect was found for both compound and noncompound pairs, as R-cued pairs yielded higher accuracy than F-cued pairs. There was evidence of incidental learning of associations between words with pre-existing associations, as accuracy for F-cued compound pairs was above chance. This finding suggests that incidental learning may be dependent on lexicalization, familiarity, or unitization. Accuracy was greater in the elaborative encoding condition; however, this did not seem to affect the directed forgetting procedure as accuracy for compound pairs was still above chance in both encoding conditions.

### Morphological Processing in Aging Bilinguals: Evidence from Inflectional and Derivational Priming

**Jana Reifegerste, Kirill Elin & Harald Clahsen**

Lying at the core of language, morphology is closely linked to syntax. The topic of bilingualism and aging has attracted a lot of attention in the past decade, largely due to the positive effects that speaking more than one language purportedly has on cognitive processing. Yet, relatively little is known about whether the linguistic skills of second-language (L2) speakers change with age, and if so, how. Is a late-learned L2 more prone to decline than a native language? Or might the performance of older L2 speakers in fact become more native-like, due to their life-long experience with their second language? In the present study, we examined how aging affects language performance, specifically morphological processing, in both L1 and L2 speakers.

Studies with younger adults have reported differences in how L1 and L2 speakers process polymorphemic words. One specific contrast concerns the processing of derived versus inflected words. While previous research has found robust priming effects for derivations in both L1 and L2 speakers, inflections usually yield priming only for L1, but not for L2 speakers (Jacob, Heyer, & Verissimo; in press; Kürkçü & Clahsen; 2013; Verissimo, Heyer, Jacob, & Clahsen, in press).

In a masked-priming experiment, we examined older L1 and L2 speakers’ priming effects for derived and inflected German word forms (Warnung ‘(the) warning’ vs. gewarnt ‘warned’) and compared them to results from a group of younger L1 and L2 speakers (mean ages: 62 years vs. 24 years). Consistent with previous research on lexical processing in aging, we found an effect of aging on general measures of language performance, with longer RTs and higher accuracy rates for both older L1 and older L2 speakers compared to their respective younger counterparts. The priming patterns, however, revealed a robust L1/L2 contrast, irrespective of age. While both L1 and L2 speakers showed significant derivational priming, only the L1 speakers demonstrated inflectional priming – this pattern is in line with previous research on younger L1 and L2 speakers’ processing of derivations and inflections. Apparently, morpho-syntactic processing as revealed by inflectional priming effects functions efficiently in the L1, but not in a late-learned L2, even after several decades of immersion in the L2. The robust derivational priming effect that was seen in both younger and older L1 and L2 speakers, on the other hand, indicates intact morpho-lexical processing of derived forms in all groups of participants. In conclusion, it appears that general language performance is affected by aging in both L1 and L2, while differences between native and non-native processing are more robust and persist into old age.

### Pronoun Interpretation Problem in Dutch–German Bilingual Children: On the Role of Language Dominance and Language Influence

**Regina Hert, Anike van Oosterom, Petra Hendriks & Esther Ruigendijk**

My master thesis is on the subject of comprehension of (object) pronouns and reflexives in relation to language dominance and language influence in bilingual Dutch–German children. As known from previous research, Dutch-, English- and Hebrew-speaking children display difficulties regarding the interpretation of pronouns (cf. Chien & Wexler 1990, Ruigendijk et al. 2010, Ruigendijk et al. 2011), whereas age-matched German-speaking children have mastered the difference in the
interpretation of reflexives and (object) pronouns (Ruigendijk et al. 2010). A sentence like John washes him can be interpreted as John washes himself by an English-speaking child, age 4. This means that the pronoun him is in a coreference relation with the antecedent John. The German equivalent John wascht ihn will not lead to a coreference interpretation by a German-speaking peer. The resulting question is: how will bilingual children behave growing up with one language where the difference in the interpretation of reflexives and pronouns is acquired at an earlier stage, and one language where the delay in the interpretation is still present at the same developmental stage? In my master thesis I am focusing on language dominance and a possible crosslinguistic influence. I want to find out whether the results of the comprehension task can be explained by language dominance, i.e. if there is a correlation between the performance on the comprehension task and their language proficiency. Further, I want to investigate if an influence from one language to the other can be identified and in what way language dominance and language influence relate to each other. A first analysis shows that the bilingual children's performance on the German part is less correct compared to monolinguals: 82% correct reflexives and 76% correct pronouns for bilinguals, while monolinguals performance was around 90% for both reflexives and pronouns (cf. Ruigendijk et al. 2010). Compared to monolingual Dutch children of 90% correct reflexives and 75% correct pronouns (cf. Ruigendijk et al. 2011), the bilingual children performed on the Dutch part less accurately with 81% correct reflexives and 65% correct pronouns. Further analyses have to be conducted in order to find out whether these results can be explained by language dominance and/or language influence.

References

In this work, we explore the possibility of learning a function that maps the phonological form of a word into a distributional semantic space. Such a function would be consistent with the hypothesis that the relation between form and meaning is not completely arbitrary (Monaghan, Christiansen, & Fitneva, 2011; Monaghan, Shillcock, Christiansen, & Kirby, 2014). Furthermore, such a function would set the stage for providing an alternative account for how children learn this relation, possibly without relying on lexical categories to mediate between form and meaning (as hypothesized by Christophe, Guasti, Nespor, Dupoux, and Van Ooijen (1997)).

To address these questions, we made use of the 16 non-words from the study by Fitneva, Christiansen, and Monaghan (2009). These non-words were created so that 8 of them phonologically resembled the prototypical English noun and the other 8 phonologically resembled the prototypical English verb. Thus, these non-words cluster at the opposite ends of the phonological typicality spectrum, from very noun-like to very verb-like. Typicality was computed from the phonological forms of nouns and verbs in CELEX (Baayen, Piepenbrock, & Gulikens, 1995) as detailed in Monaghan, Christiansen, Farmer, and Fitneva (2011). Children were aurally presented with the non-words and asked to map them to one of two pictures, either an entity or an action. It was found that children's choices correlated with the calculated phonological typicality scores.

To obtain a function mapping form onto meaning, we first derived a distributional semantic space from a corpus of child directed speech derived from CHILDES (MacWhinney, 2000) using discriminative learning (Milin, Feldman, Ramsscar, Hendrix, & Baayen, 2017). Following Baayen et al. (in preparation), each word in the corpus was morphologically parsed and lexemes were assigned to both lexical units and to inflectional and derivational affixes. Each word form was represented by its constituent triphones, i.e. sequences of three phonemes. We then calculated the matrix mapping the triphone matrix onto the semantic matrix; this transformation matrix, which represents the form-to-meaning function, was used to generate semantic vectors from the triphones of the non-words.

In Study 1, we computed the pairwise correlations between non-words’ semantic vectors and the semantic vectors of all the words in the corpus, selecting the 50 words with the highest positive correlation to each non-word and retrieving the corresponding lexical categories. The frequencies of each category across the 50 nearest neighbours were input to a Linear Discriminant Analysis (LDA). In Study 2, each non-word's semantic vector was correlated to the semantic vectors derived for the affixes and the resulting correlation matrix was input to an LDA. Finally, in Study 3, we borrowed the approach outlined by Westbury (2014) and correlated the non-words’ semantic vectors with the semantic vectors of 20 early acquired words (as indicated by the age-of-acquisition norms in Kuperman, Stadthagen-Gonzalez, and Brysbaert (2012)), 11 nouns and 10 verbs, again using these correlations as input to an LDA.

Across all studies, classification was reliable. Moreover, classification confidence of the LDA significantly correlated with phonological typicality and children's choice behaviour, as reported by Fitneva et al. (2009). This suggests that it is possible to learn a form-to-meaning mapping and generalize it to new forms, without making reference to grammatical categories. This finding is relevant to the debate about the arbitrariness of

On the Semantics of Non-words and their Lexical Categories
Giovanni Cassani, Yu-Ying Chuang & Harald Baayen

The 11th International Conference on the Mental Lexicon
Language abilities during the preschool years are among the strongest predictors of children’s later academic achievement (NELP, 2008). Importantly, the preschool years have also been implicated as a period of rapid development of children’s executive function (EF) ability (Garon, Bryson, & Smith, 2008). EF refers to the higher-order cognitive control that is necessary to monitor and regulate one’s thoughts and actions to develop cognitive and social competence (Blair, 2002). Preschool children’s performance on EF tasks is associated with their early language abilities (e.g., Allan, Hume, Allan, Farrington, & Lonigan, 2014). For example, EF skills at the beginning of preschool predicted vocabulary scores at the end of preschool (controlling for beginning-of-year vocabulary) (Weiland, Barata, & Yoshikawa, 2014). No known study has examined relations between EF scores and particular types of miscues and responses that preschool children say on vocabulary naming tasks. For this exploratory study, we examined whether children’s EF scores were significantly negatively correlated with particular types of miscue response based on a coding system (McGregor, Newman, Reilly, & Capone, 2002).

There were 30 children (n=11 males) who participated in this study (Mean age = 57.3 months, SD = 6.4; Range = 48 - 70 months). Research assistants met individually with each child to administer measures of EF (Head Toes Knees Shoulders Task; McClelland, Cameron, Connor, Farris, Jewkes, & Morrison, 2007) and expressive vocabulary (Expressive One-Word Picture Vocabulary Test, Fourth edition, Brownell, 2000). Parents completed a demographics questionnaire. The children’s responses were coded by type. Responses coded as semantic miscues were those that involved super-ordinate substitutions (e.g., food for pineapple), sub-ordinate substitutions (e.g., chicken for bird), coordinate substitutions (e.g., tiger for cheetah), colocations (e.g., box for mail), circumlocutions (e.g., something that you eat for apple), distant semantic (e.g., fever for thermometer), semantic phonological (e.g., footsteps for footprints), and onomatopoeia (e.g., boing for springs). Responses coded as phonological miscues were those that were phonologically similar (e.g., studio for stadium). Responses coded as visual miscues were those that involved visual misperception of target. Responses coded as random were unrelated semantically, phonologically, or visually. Inter-rater reliability was acceptable.

A total of 754 miscues were coded. Miscues were calculated for each child as a proportion of the total number of their responses (i.e., basal to ceiling). Some items on the measure had a high number of children who provided the same response (e.g., 21/30 children said doctor for dentist). No children achieved the maximum score (i.e., 40) on the HTKS measure (Mean = 20.8; SD = 13.4). Expressive Vocabulary scores were within normal range (Mean = 111.8; SD = 13.3). HTKS scores were significantly correlated with expressive language scores using partial correlations controlling for age, r = .44, p = .04. Bivariate correlations for EF and vocabulary yielded only a significant correlation between the HTKS scores and miscues that were random, r = -.53, p < .05.

Children who have high EF scores are unlikely to provide responses that are unrelated to the target. Understanding relations between preschool children’s language abilities and EF is necessary for supporting children prior to formal school entry to identify potential mechanisms responsible for the acquisition of academic and socio-emotional skills.
conventional than more novel metaphors. Once all participants read the story and responded to the questions, they performed a recognition task, where they were presented with the same metaphors in both short and long format and asked to identify the format they saw in the stories. If people tend to truncate more conventional metaphors when presented in the long format, then they should also produce more false alarms for these metaphors on the recognition task. Consistent with this hypothesis, results show that participants recognized more conventional metaphors when they were encountered in the short format and more novel metaphors when they were encountered in the long format.

**Computational Modeling of an Auditory Lexical Decision Task using jTRACE**
*Filip Nenadić & Benjamin V. Tucker*

The goal of this study is to implement jTRACE (Strauss et al., 2007) for modeling the auditory lexical decision task. jTRACE is a computational implementation of the TRACE model (McClelland & Elman, 1986), one of the first computational models of spoken word recognition (Weber & Scharenborg, 2012). In this presentation, we attempt to model latency estimates for both word and pseudoword input and compare the obtained values to actual listener responses collected as part of the Massive Auditory Lexical Decision (MALD; Tucker et al., submitted) project. As one of the main points of disagreement between models of spoken word recognition is word competition, we investigate jTRACE model performance when the lexicon includes a large number of close competitors. Our simulations show that for words the winning word is almost always selected after the word offset, which is generally in line with listener behavior. This is a consequence of the lexicon including all of the close competitors for the target word. However, this also leads to jTRACE simulations often having difficulties selecting the target word as the winner even at word offset. When pseudowords are investigated, simulations show two patterns. First, the word activations decrease severely (below 0) as soon as the pseudo-word diverges from all existing words in the lexicon. Second, a very sharp triangle wave of activation values is observed, shifting from negative to positive activation rapidly. In both cases, activation drops below 0 for all competitors prior to word offset. Therefore, word competition seems to be adequately simulated, with the decision of the winning candidate depending on a parameter of activation difference between top two candidates, which is set by the researcher. However, the drop in activation for pseudowords could indicate that the decision can be made even during stimulus presentation, which is incongruent with participant behavior, as response latencies for pseudowords are regularly longer than response latencies for words. One possibility is that the human recognition process searches for a winner until one is found or sufficient time past word offset passes, even if it is clear that all the words in the lexicon have negative activation. If that is the case, input duration becomes even more important, and this notion is supported by the importance of duration in statistical models predicting response latencies in behavioral experiments. We argue that stimulus duration should be included in any response latency estimation made by computational models. In case of jTRACE, it could be added post-hoc, and then augmented by the time required to select the winner past word offset, at least until future developments allow for using actual acoustic input rather than phonemes represented by pseudo-features.

**What Makes a Compound a Compound? Evidence from Connected Speech**
*Hilary Wynne & Aditi Lahiri*

English compounds are often identified by specific semantic, morphological, and prosodic criteria (cf. Bauer, 2009). In addition to word stress, there are other prosodic qualities that distinguish compounds from phrases: previous psycholinguistic research has indicated that, despite containing two or more lexical units, English compounds are treated as single prosodic units in connected speech. However, much of this evidence comes from tasks comparing concatenated, semantically-transparent compounds (e.g. nightgown) to phrases (e.g. nice mare); following this, there is a possibility that this finding is simply an artefact of the visual spaces in the target stimuli. This study looks at how speakers encode other types of English compounds, such as spaced (e.g. time zone) and opaque (e.g. toadstool) compounds.

**The Time-based Demands of Visualization**
*Simritpal K. Malhi, Cassidy Kost & Lori Buchanan*

The literature reports the concreteness effect (Paivio, 1991) as a processing advantage for concrete words over abstract words. For example, with respect to processing time, concrete words are responded to more quickly than abstract words. This processing advantage has been explained in terms of concrete words, unlike abstract words, activating the imagistic system (Paivio, 1971). However, this may be task-dependent, such that in certain tasks, the imageability/visualization property...
of concrete words would not result in a processing advantage (Malhi & Buchanan, 2018). Specifically, Malhi and Buchanan (2018) showed that in an iconicity judgment task, participants were slower at responding to concrete words than abstract words. In an iconicity judgment task, participants are shown word pairs and are asked to decide if the position of the words on the computer screen matches how their referents appear, either in everyday objects (for concrete words; e.g., monitor – keyboard) or in relationships (for abstract words; e.g., happy – sad). Malhi and Buchanan (2018) proposed that, in the iconicity judgment task, with concrete word pairs, the first step is visualization and the second step is mental manipulation. In contrast, because abstract word pairs cannot be visualized, there is only the single step of mental manipulation. Thus, this two-step process for concrete words involving visualization places time-based demands that slow down processing. The present study sought to test this proposal by asking participants questions about strategy use for the iconicity judgment task (Experiment 1) and by supplying an aid for visualization to see if this would reduce the time-based demands (Experiments 2 and 3).

The results of Experiment 1 showed that, for the concrete words, visual-spatial reasoning emerged as the major theme in the qualitative analysis, and in the forced-choice question, 100% of participants endorsed using a visualization/imagining strategy. In Experiment 2, participants were primed with letters occurring 11 times more often than w/, r/, d/. These questions were addressed by taking advantage of the fact that certain Arabic letters (j/w, 1/a, 2/8, 3/d, 2/3/z, 4/4) cannot connect with subsequent characters. When these letters occur, they have the effect of separating the word into two or more strings of connected letters, or graphemic chunks (Perea et al., 2013). The influence of letter connectedness was therefore examined by testing words that differed in terms this chunking -- specifically, one-chunk words (ضْرِيفَنَ) /mxFD/ (low, in which all letters are connected), two-chunk words (جَهَانِم) /mnAhj/ (methods), and three-chunk words (عَادَمْ /mwaqf/ agree) -- but that were otherwise matched in terms of length (5 letters), orthographic form frequency, pointed/unpointed stem frequency, and morphological root frequency (Boudelaa & Marslen-Wilson, 2010). Experiment 1 (EX1; N = 32) used a lexical decision task with masked identity priming (عَادَمْ /mwaqf/ agree), while Experiment 2 (EX2; N = 32) used the same task with masked one-letter-different (1LD) form priming. Form primes were ortho/phonotactically licit nonwords that differed from the target by a morphological root letter (عَادَمْ /mwaqf/ agree).

In both experiments, RTs were longer for words consisting of fewer graphemic chunks (1-chunk > 2-chunk > 3-chunk; both p's < .001), indicating processing costs for letter connectedness. This effect was also found for 1-, 2-, and 3-chunk nonwords in both experiments, further suggesting that this processing difficulty is due to letter connectedness, and not some uncontrolled-for lexical factor. EX1 yielded comparable identity priming regardless of chunking (prime-target relatedness, p < .001; priming for each word type, p < .001). In EX2, contrary to previous results, priming was not significant. In conclusion, the results suggest that the time difference between concrete and abstract words in the iconicity judgment task is related to visualization. When participants are supplied with a visual aid, this reduces the time-based demands. However, the type of visual aid is important in that it should assist the second step of mental manipulation.

References

In Arabic words, letters are joined together (as in English cursive) even when they are presented in print, and the shape of each letter depends on the letters that it is connected to, leading to allographic variation. These characteristics of Arabic orthography pose special challenges for visual word recognition. In particular, this letter connectedness might impede letter identification processes as well as the mapping of letter forms to their abstract orthographic representations (Boudelaa & Marslen-Wilson, 2010; Carreiras et al., 2012; Ganayim, 2015). In light of these challenges, the present study investigated the processing consequences of letter connectedness during Arabic visual word recognition. More specifically, this study examined (a) whether there is a processing cost associated with letter connectedness and (b) whether this factor modulates form priming in Arabic. The latter question is of particular theoretical interest because previous research has found no form priming in Arabic when the prime and the target differ by a letter associated with the morphological root (ضْرِيفَنَ /mxFD/ noble; see e.g., Frost et al., 2005) -- a result that has been taken to indicate that the Arabic lexicon is organized based on morphological, rather than orthographic, principles.

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Letter Connectedness and Arabic Visual Word Recognition
Ibrahim Alluhaybi & Jeffrey Witzel

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indicating no orthographic form priming in Arabic, there was robust 1LD form priming effect when collapsing across 1-, 2-, and 3-chunk words (prime-target relatedness, p = .001). However, this effect appeared to be modulated by letter connectedness, in that planned comparisons yielded reliable priming only for 3-chunk words (p < .01; 1-chunk: p = .15; 2-chunk: p = .07).

Taken together, these findings indicate (a) that there are clear processing costs for letter connectedness during Arabic visual word recognition and (b) that this factor should be accounted for (and controlled) when examining the organizing principles of the Arabic lexicon.

### Word Neighborhood Influences Lexical Access and Benefits L2 Students (Portuguese) in a L1 (Spanish) Context

**Alma Luz Rodríguez Lázaro**

Reaction times (RT) is a useful tool for gathering data regarding psycholinguistic processes, when combined with tasks such as lexical decision on words and pseudowords in one particular language. In addition, different stages in language acquisition might play an important role in bilinguals’ lexical access (Potter, So, Von Eckard & Feldman, 1984). Furthermore, the neighborhood effect across languages (Bieljac-Babic, Biardeau & Grainger, 1997) suggests that word recognition is influenced by similar orthographic characteristics between lexical elements. The aim of this research was to identify RT differences in the acquisition of a second language (L2) for learners of Portuguese or English when Spanish is their first language (L1). The research took place in a Mexican university. L2 acquisition level was considered in order to classify students into three groups: beginners, intermediate and advanced learners. Our hypothesis suggested that if L2 is similar to L1, RT will be shorter when identifying pseudowords vs. words. Additionally, advanced L2 acquisition will contribute to identifying pseudowords vs. words correctly.

Thirty Mexican college students enrolled in a language course, such as Portuguese (PL2) or English (EL2), participated in this research. The mean age of the students was 24.5 (SD=2.2). Participants’ L2 background information was collected in order to know the age of acquisition of the L2 (EL2 mean=12; SD=7.5; PL2 mean=22; SD=3.5). The classification of L2 acquisition on students was considered according to the level in which they were enrolled when the application of the task was performed. Cognate words were excluded and only concrete words no longer that 5 graphemes were included. In total, 30 trials were presented to each participant according to their L2.

The main results demonstrated significant differences in RT. PL2 beginners group was faster than EL2 beginners group (t=-3.64, p<0.035). In addition, advanced PL2 group was faster in RT than EL2 advanced group (t=1.53, p<0.008). On the other hand, no significant differences were found in the recognition of pseudowords and words between language groups. In contrast, differences in recognition of pseudowords were significant in PL2 beginners vs intermediate participants (t=0.44, p>0.047). In other words, intermediate learners obtained higher scores.

These results demonstrate that RT reveals faster PL2 word recognition processing in contrast to EL2 when measured in a Spanish-speaking context. That is, word neighborhood, such as Portuguese and Spanish words, influences lexical access. Accordingly, we can assume when L2 is similar to L1, lexical access will be faster and more accurate at identifying pseudowords. It is intriguing that EL2 participants had started studying English around puberty; therefore, they have experienced L2 input for a longer amount of time. Nevertheless, the effects of this experience did not help them to efficiently recognize pseudowords when compared to PL2 group. More studies are needed to find more evidence to support this aspect of the research.

### References:


### Following the Path of Lexical Access in Bilinguals (Spanish-English) through Eyetracking

**Alma Luz Rodríguez Lázaro & Natalia Arias-Trejo**

Lexical access has suggested a cascade processing when auditory and visual information of words are presented to native speakers (Huettig & McQueen, 2007). That is, retrieval of phonological and semantic knowledge, as well as visual-shape information, previously stored in memory, play an important role in word recognition. Moreover, it is intriguing that bilinguals seem to develop two lexical systems or if they combine lexical information in one system (Obler & Gjerlow, 2000). Therefore, lexical access and its processing has been measured with eyetracking as a means of analyzing this phenomenon. Thus, the aim of this study is to provide evidence that cascade processing in bilinguals, (Spanish-English) in a Mexican university context, is similar that observed in native speakers. Pilot testing results will be presented in this abstract since this research is still in process.

### Sample

20 Mexican college students enrolled in English as a Foreign Language courses were recruited. Two groups were formed according to proficiency in English: high proficiency and low proficiency.
Does Spacing Help Reading Languages with Non-spaced Texts? A Study On Mandarin Chinese

Gaisha Oralova & Victor Kuperman

Word segmentation plays a central role in spoken and visual word identification. In most languages, inter-word spaces and hyphenation are used as word boundary cues, which make word identification more efficient (Bertram et al., 2011). When spaces are removed, reading pace in these languages slows down and both oculomotor and word recognition processes are disrupted (e.g., Perea & Acha, 2009). Since there are no explicit cues for segmentation between words in Chinese texts, one can expect that readers of Chinese experience difficulties with identifying word boundaries in a continuous string of characters. However, previous research showed that Chinese readers read un-spaced texts as easily as spaced texts (Bai et al., 2008). Another intriguing consequence of the un-spaced nature of Chinese texts is that readers often disagree on what strings of characters in a sentence represent a word, and show only moderate consensus when placing word boundaries in a word segmentation task (Liu et al., 2009). This study examined the processing outcomes of introducing spaces in Chinese sentences, in positions that are recognized as probable word boundaries with a varying degree of consensus. We used 220 sentences from Liu et al. (2013) and Wang et al. (2015) where every transition between characters is associated with a segmentation probability (i.e. percent of raters who placed a word boundary in that position). Original un-spaced sentences and their counterparts with spaces at character transitions were presented for reading for comprehension to 28 native speakers of Mandarin, while their eye-movements were recorded. Two counterbalanced lists presented a mixture of spaced and un-spaced sentences, such that every participant saw each sentence in only one format. We predicted that an overall effect of spacing will be facilitation of the reading effort, especially when (i) spaces are inserted in the positions where a boundary before or after a word is judged to be more likely, and (ii) towards the end of an experiment, when the learning experience enables readers to accommodate to the unconventional convention of spacing. Linear mixed-effects models showed that spaced words took faster to read than un-spaced ones (total reading times, 299 and 313ms, respectively, p < 0.001), but spaced and un-spaced sentences came with the same reading times (p > 0.76), which may be explained by increased skipping rates in the un-spaced condition (4% difference). Surprisingly, no effects of word boundary probabilities on eye fixation durations emerged in either spaced or un-spaced conditions (all ps > 0.10). There was no indication of a learning effect either: words and sentences both were read faster towards the end of the experiment regardless of the spacing condition (ps < 0.01 for both). The results indicate, contrary to prior claims, that spacing can serve as an efficient segmentation cue in reading un-spaced languages and that the advantage that spacing grants is independent of the distributional statistics of Chinese orthography.

Variability and Consistency in L2 Morphology: An EEG Production Study

Anna Jessen, Joao Veríssimo & Harald Clahsen

Speaking a late-learned second language (L2) is supposed to yield less consistent output than speaking one’s native language (L1), particularly with respect to reliably producing grammatical morphology. A prominent approach in second language research holds that variability and inconsistency in L2 morphological output is due to ‘processing difficulties’ (e.g., Hopp, 2013; White, 2003). The current study investigates both internal processes involved...
in encoding morphologically complex words, with ERPs during production, and the corresponding overt output. We examined the plurals-in-compounds effect in English, which refers to a three-way contrast between compounds with plural or singular modifiers. Specifically, compounds with singular non-heads are fully acceptable (e.g., rat eater), those with irregular plurals are marginally acceptable (e.g., mice eater), and those with regular plurals are unacceptable (e.g., rats eater; Kiparsky, 1982; Gordon, 1985; Jaensch et al., 2014).

Thirty-one advanced adult L2 speakers of English (L1: German) were compared to two control groups of L1 English speakers from an earlier study: 20 adults and 53 elementary-school-aged children (Budd et al., 2015). Participants were prompted to first silently and then overtly produce an acceptable compound out of a verb and a noun (e.g., eat rats -> rat eater). The experiment employed 160 critical items, created from 8 nouns with regular and 8 nouns with irregular plurals, which functioned as non-heads, and were matched for frequency, length and meaning (e.g., mice/rats, geese/ducks, feet/hands, etc). These 16 non-heads of noun-noun compounds appeared in their singular and their plural form, combined with 5 (out of a set of 16) different verbs (e.g., eat, pat, collect, …). We analysed (i) electrophysiological responses during the silent production of the compounds and (ii) the corresponding overt productions of the compounds. Regarding (i), ERP analyses revealed an enhanced negativity, during the (silent) production time window from 300-450ms after stimulus onset, for correct compounds produced from regular plural forms (e.g. eat rats -> rat eater) relative to compounds from irregular plurals (e.g. mice), for all participant groups (i.e., L2 adults, L1 adults, L1 children). No difference in the ERP responses was found for their singular counterparts (e.g., rat vs. mouse). However, for the child group, the ERP effect obtained was substantially delayed compared to both (L1 and L2) adult groups. Regarding (ii), we obtained a clear L1 vs. L2 contrast in participants’ overt productions of compounds. While both the child and the adult L1 groups rarely produced illicit (i.e., regular plural) compound-internal modifiers (5% and 12%, respectively), the L2 speakers did so considerably more often (32%), yielding more variable output than the L1 groups. To formalise the constraints on inflection inside compounds, we constructed a set of Harmonic Grammars (Goldrick et al., 2016; Verissimo, 2016) that enabled us to precisely model the similarities and differences in L1 and L2 speakers. Our results demonstrate brain responses associated with morphological encoding to be similar for both L1 and L2 speakers, despite more variable and inconsistent output in the L2 than in the L1. Hence, increased morphological variability in L2 production is, at least in this case, unlikely to be to ‘processing difficulties’. We argue instead that the L2 grammar gives less weight to structural constraints than the L1 grammar.

Combining words into compounds reflects the ability to convey complex meaning by combining units from limited sets. Libben (2014) notes that although the concept of compound words may seem simple, insight into their comprehension is valuable for understanding lexical processing in general and cognitive representation of human language at large. Therefore, studying compounds in languages with different internal structures opens up new windows on these fundamental processes. In the present study, we use a memory task rather than reading or word processing to study noun-noun compounds maximizing sensitivity to spreading activation and competition processes in the mental lexicon.

Headedness refers to the order of the syntactic roles (modifier and head) in noun-noun compound words. Unlike English where the second constituent of a noun-noun compound word is always the head (e.g. a firehose is a hose for fire), Persian, another Indo-European language, allows variable head positions of its compounds (Kalbasi, 1997; Shariat, 2005; Foroodi-Nejad and Paradis, 2009). Such variability in headedness between languages raises the question of different processing based on different internal structures. Despite a significant body of research on the processing of compound words, to our knowledge, there are no published studies on the effects of headedness on recall of compounds, to inform us about how the brain processes competing syntactic and semantic structures. This paper describes the results of memory span for Persian compounds with different head positions. A total of 35 native Persian speakers were tested. The overarching question was how recall may be affected by headedness and different lexical variables. Since right-headedness is the default in Persian (Kahnemuyipour, 2014), we hypothesized that right-headed (RH) compounds are processed and remembered better than their left-headed (LH) counterparts. More specifically, we were interested to know if it is more likely for Persian speakers to forget the head than the modifier and if this would be different for head-initial versus head-final compounds. We created a design to control for frequency and formed 5 different lists of auditory stimuli. One pair of lists consisted of RH and LH compounds where the same head occurred in matched compounds as either a right or a left head. Another pair of lists consisted of compounds with different constituents, the head always in its typical right or left position. A final list type had RH compounds in which the head could only be in the right position. Preliminary data analyses confirmed better recall for the most common RH compounds versus the most common LH ones (F(3,4) = 5.89, p < .0001). This analysis will be refined by adding rated Familiarity, Age-of Acquisition and Imageability to a mixed model analysis. We are in the process of compiling these values, which are not available for Persian. An error analysis will report on different error categories such as omissions or replacements of heads or modifiers, switching the places of the constituents, as well as possible reconfigurations. This analysis helps us understand to what extent the different syntactic-semantic roles of modifier and head affect activation.

**The Structure of Persian Compound Words in the Mental Lexicon**

*Narcisse Torshizi & Elisabet Service*
It is commonly believed that hyphenation in compounds tends to be conventional and highly arbitrary, so hyphenated compounds have been largely neglected in the past studies on compounding or morphology. In this study, we propose that the use of hyphenation in compounds in English, especially compound adjectives, strongly motivates the breaking of compounding production principles. There are two core characteristics of most English compound words: right headedness (Plag 2003:135) and grammatical combination. Compound heads usually occur on the right-hand side. The compound as a whole acquires most of its semantic and syntactic information from its head. For instance, if the head is a count noun, the compound will be a count noun (e.g. houseboat). Compounding is usually treated as an important morphological strategy; however, an important principle for creating compounds is to combine words following syntactic orders, mainly including: Subject + Verb, Verb + Noun, Adjective + Noun, Noun + Noun. We find that most hyphenated adjectives and over two-word hyphenated compounds follow neither the principle of right headedness nor that of syntactic order. In order to gain a better understanding of hyphenated compounds and their development, we conduct a quantitative investigation into distribution of frequency extracted from COHA to explore how hyphenated compounds have been used in English in the last two hundred years. We will answer the following question in this study: 1) Does the change in the frequency of English hyphenated compounds follow laws? 2) What motivates the use of hyphens in English compounds? Will hyphens in compounds vanish in future? A quantitative investigation shows that the frequencies of tokens and types in hyphenated compounds have been increasing in the last two hundred years, and the distribution of frequencies of both types and tokens follows the Logistic Regression (the Piotrowski Law, Piotrowski 1974) which has been found in many phenomena of language changes. This study analyzes what has made contributions to these changes in frequency of hyphenated compounds. Additionally, there three types of compounds: spaced compounds, hyphenated compounds, and solid compounds according to their orthographic forms, and a popular view holds that compounds follow a gradual evolution from spaced form or hyphenated form to solid form. We investigate how three orthographic forms of compounds compete historically. Comparisons are made for some typical cases among three kinds of forms by the use of Google N-gram Viewer. It turns out that hyphenation in compounds, as an orthographic form, does not seem to easily die away, especially in compound adjectives and phrasal compounds. Obviously, reasons of familiarity and economy in previous cognitive studies on compounding (Kuperman & Bertram 2013) cannot provide an adequate account of this. We therefore provide a different perspective to take hyphenation into account adequately: people probably unconsciously take advantage of markedness to indicate that some of these combinations are quite unique. From the perspective of grammaticalization and lexicalization, some hyphenated compounds might be undergoing grammaticalization although lexicalization in phrasal compounds is still in progress. The contradictory processes take effect on hyphenated compounds simultaneously. Compounding involves syntactic orders though compounding is seen as mainly engaging morphology. However, the rise of hyphenated compounds also implies that the boundary of syntactical and morphological methods is becoming increasingly vague in modern English. More generally, this study makes a significant contribution to a better understanding of the nature of hyphenated compounds, the diversity of compounding, and the relationship between morphology and syntax.

References:

Kun Sun

Diachronic and Qualitative Analysis of English Hyphenated Compounds in the Last Two Hundred Years

The Kamin Blocking Effect in Speech Acquisition: Non-native Acoustic Cue Learning is Blocked by Already-learned Cues

Jessie S. Nixon

Introduction.
In animal learning, if a cue (e.g. light) is associated with an outcome (electric shocks), and later two cues (light + tone) occur with the outcome, learning of the second cue (tone) can be ‘blocked’ or diminished by the already-learned cue (Kamin, 1968). This suggests that rather than simple co-occurrences, cue learning depends on a cue’s ability to predict outcomes (Rescorla, 1988, 1968). Changes in cue weighting result from cue competition (Ramscar, Dye, & McCauley, 2013). Over the last two decades, research has shown that listeners are highly
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The present study investigates whether non-native acoustic cue learning can be blocked by already-learned cues.

Method
In an online game, 191 native English speakers heard Southern Min words and saw pictures of ‘alien’ objects (original size and diminutive). Words were mid-level or high-level tone with a nasal or oral vowel. The experiment had three phases: pre-training, training, and test. Training was the same for all groups and involved both cues: baseline mid-tone, oral words (original size) vs. high-tone, nasal (diminutive). Participants either received blocking pre-training or control pre-training. Blocking pre-training participants heard a single cue (e.g. high-tone words). During test, the cue that was not pre-trained (e.g. nasal words) was tested. Control pre-training participants heard unrelated cues, not presented in training or test.

Results
Figure 1 shows the results. A glmer model showed accuracy was higher for original size than diminutive pictures. Condition was not significant for original size, probably because it was the baseline with no additional cues, so was selected most often. However, for the nasal cue, accuracy was significantly lower after blocking pre-training, compared to control pre-training. Having learnt the tone cue, uncertainty was reduced and learning the nasal cue was blocked. In contrast, there was no blocking effect for tone. The nasal cue was not fully learned during pre-training, and therefore did not block the tone cue because it left sufficient uncertainty to drive further learning in the training phase.

Discussion
The present study shows that already-learned acoustic cues can block learning of new cues. This result has important implications for theories of speech acquisition. Firstly, it suggests that acoustic knowledge may not always match the statistical input distribution, but will depend on the predictive structure of learning events.

Key results
• longer overall RTs – Mean RT L1(L1): 632ms / Mean RT L1(L2): 676ms (p < .001)
• higher error rates for primes in L1(L2) group (more nonwords accepted as words)
• L1(L2) group only shows priming for existing condition (p =

Investigating ‘Nativeness’: L1 Morphological Processing in an L2-dominant Environment
Sandra Kotzor, Swetlana Schuster & Aditi Lahiri

Native (L1) competence is frequently considered a stable property which has led to experiments being conducted with (bilingual) L1 speakers in L2 immersion settings. However, recent language attrition research has promoted a more dynamic approach to the relationship between L1 and L2, reporting early performance effects (e.g. lexical access in naming tasks; cf. Schmid & Jarvis 2014). Thus, possible differences in performance between L2-immersed speakers (L1(L2)) and L1 speakers in native settings (L1(L1)) may have both methodological and theoretical implications for our understanding of language processing.

Here, we report the results of a morphological priming task with L1(L2) speakers from a methodological perspective as well as in the context of language attrition research. Our research addresses the following questions:

1. Are the results of studies with these populations comparable to those in L1 environments?
2. How does language attrition affect morphological processing?

Overall, the specific processes underlying morphological processing remain controversial (Amenta & Crepaldi, 2012). In L2 morphological processing, a declarative vs. procedural model has been proposed (Ullman 2004). Native speakers are said to rely more on the procedural system, leading to greater decomposition effects compared to L2 learners.

Participants

• L1(L1): native German speakers in an L1 setting (in Frankfurt, Germany)
• L1(L2): native German speakers living in the UK; highly proficient in English (LoR > 2yrs; day-to-day use of L1 <15%)

Task
• visual lexical decision task with delayed priming (5-7 items between prime & target)
• three conditions with derived complex items (Adj > V > N) differing in the number of lexical gaps in the two-step derivation (cf. Table 1; + form and semantic controls)

Table 1 Examples of morphological conditions in delayed priming task

<table>
<thead>
<tr>
<th>Condition Prime (noun)</th>
<th>Target (adjective)</th>
<th>No. of lexical gaps in two-step derivation; violation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Heilung ‘healing’</td>
<td>HEIL ‘whole/unhurt’ no gaps and no violation</td>
<td></td>
</tr>
<tr>
<td>Non-existing 1 *Spitzung SPITZ ‘sharp’ one gap, V. (spitzen) attested, N. legal but unattested</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-existing 2 *Hübschung HÜBSCH ‘pretty’ two gaps, both N. &amp; V. are legal but unattested</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Condition Prime (noun) Target (adjective) No. of lexical gaps in two-step derivation; violation

Existing Heilung ‘healing’ HEIL ‘whole/unhurt’ no gaps and no violation
Non-existing 1 *Spitzung SPITZ ‘sharp’ one gap, V. (spitzen) attested, N. legal but unattested
Non-existing 2 *Hübschung HÜBSCH ‘pretty’ two gaps, both N. & V. are legal but unattested

Key results
• longer overall RTs – Mean RT L1(L1): 632ms / Mean RT L1(L2): 676ms (p < .001)
• higher error rates for primes in L1(L2) group (more nonwords accepted as words)
• L1(L2) group only shows priming for existing condition (p =
Evidence has arisen showing that phonologically homophonous units such as stems and phones differ in their fine phonetic detail with respect to their lexical, semantic and morphological structures (e.g. Plag, Homann, and Kunter 2017; Lee-Kim, Davidson, and Hwang 2012; Drager 2011; Kemps et al. 2005a). In the present study, we investigated the articulatory processes behind these fine phonetic details in stems undergoing morphological changes in suffixed and unsuffixed AE verbs (e.g. “clean” vs. “cleans”, “cleaned”, “cleaning”). We built our hypotheses on two pillars: The first is in regards to consistent findings which state that phonologically identical phones show varying fine phonetic details due to anticipatory coarticulation (e.g. Öhman 1966). The second pillar is that kinematic skills improve with practice, reflected among others by a stronger overlap of consecutive movement gestures (Sosnik et al. 2004). Consequently, we hypothesized that articulatory movements of verbal stem vowels should differ systematically between suffixed and unsuffixed verbs and that coarticulation of the suffix should be stronger in more practiced verbs. Using electromagnetic articulography, we recorded tongue movements of 25 native speakers of Canadian English, each uttering 210 suffixed and unsuffixed verbs containing the vowels [A:] and [i:] in their stems. We parameterized practice of words by means of word activations calculated by the Naïve Discriminative Learner (Baayen et al. 2011).

Analyses of tongue body and tongue tip movements revealed strong effects of coarticulation and word activation. Figure 1 exemplarily illustrates the regression surfaces of tongue body height in the stem form (left) and the past tense (right) during [A:] articulation. In present verbs, a lower tongue position is reached later and maintained longer for more practiced than for less practiced words. The past tense suffix (Figure 1, right) mod-ifies the trajectory with more practiced words showing a deeper articulation of the [A:] and a raising towards the dental [t] suffix much earlier. Our findings show that suffixes strongly affect articulatory patterns in homophonous stems and that they are modulated by the amount of practice speakers have with a word. Contradicting modular models of speech production (Levelt, Roelofs, and Meyer 1999), these findings have important implications for models of the phonology-morphology interaction.

This study investigates the frequency and nature of long-term dependencies in Plains Cree, a polysynthetic language of Canada. For the purposes of this study, a long-term dependency is defined as any relation between two non-adjacent morphemes within a word. Although previous literature approaches similar phenomena in referring to long distance dependency (Sag et al., 2003, pp. 427-50), these accounts often focus on movement or transformation of a sentence and its constituents from a deep structure to a surface structure. In this study, we focus solely on the observational structure of the Plains Cree verb, which can vary from monomorphemic to a complex of more than 20 morphemes (Bakker, 2006). Although morphemes can often be considered independent entities that are simply strung together, a number in Plains Cree are directly related to another morpheme in the verb. A subset of person markers, for example, make use of a prefix to indicate person and an suffix to indicate number which varies allomorphically depending on the prefix used. Other forms of long-term dependency include, at least, two types of reduplication for the verb stem’s initial consonant, and the associative circumfix, which derives transitive verbs from intransitives through valency expansion. Despite the maximal number of long-term dependencies that could theoretically occur at the same time in a word being four, we observe at most only three such dependencies at a time in our corpus as in (i). Here, the presence of the conjunct marker {ê-} morphologically conditions the person-marking suffix...
to realize as the {-ak} allomorph, while the light reduplicative {wa-} (and the heavy reduplicative {wâh-} for that matter) draws its onset from the stem, {wîcêh-}.

1. ê-wa-wâh-wîcêhak
e- wa- wâh- wîcêh- ak
CNJ RDPL-L RDPL-H s/he goes along 1SG.SUBJ:3SG.OBJ

‘I am always going along with him’
We presume that, although Plain Cree is a polysynthetic language in which it were in principle possible to exhibit a high level of parallel long-term dependencies in a single verb, the cognitive and processing load required to manage and resolve these dependencies will constrain their occurrences in natural language use. We evaluate this using a hand-annotated corpus of roughly 73,000 Plains Cree words and find, through our initial evaluation, that multiple long-term dependencies are quite infrequent, with more than 10% of verbs showing no long-term dependencies and the vast majority showing only one. Further, certain dependency types and their combinations were more frequent than others. Based on this, we analyze the nature of long-term dependencies, including dependency co-occurrence, to determine what factors play into how long-term dependencies occur and interact in Plains Cree.

References

This study examines whether the grammatical processing of heritage language (HL) speakers differs from that of dominant first language (L1) speakers of the same language. The HL is a minority language, or an immigrant language, spoken in a majority language community (Valdés, 2001, 2005). Although the HL is oftentimes the L1 of HL speakers, HL speakers are less dominant in their L1 or have not developed L1 as well as L1-dominant counterparts. This study tests Vietnamese, which is the L1 and HL of Vietnamese-English bilingual participants in the English-majority US. If the HL is acquired as the L1, then it may be the case that HL speakers have developed implicit knowledge of the L1 similar to L1-dominant speakers. The current study focuses on whether these HL speakers decompose HL Vietnamese compound words into their morphological components, whether decomposition is affected by the semantic transparency of these compounds, and whether this process is similar to that of L1-dominant speakers.

In order to investigate the implicitly acquired grammatical rules, two experiments were conducted with two groups of Vietnamese-English bilinguals, the HL group and L1 Vietnamese-dominant group. Both experiments used masked priming, in which participants were presented with a Vietnamese compound word as the prime for 50 ms. The prime was then followed by either the first constituent of the compound (Experiment 1) or the second constituent (Experiment 2) as the target. There were four types of compounds: (i) a transparent-transparent group where the first and second constituents of the compound word were both related to the overall meaning of the compound (bàn ghê, Vietnamese translation: “fur-niture”; literal meaning of the compound: “table chair”), (ii) transparent-opaque group where only the first and not the second constituent of the compound was related to the meaning of the whole compound (khó khăn, translation: “hardship”; literal meaning of the compound: “hard towel”), (iii) opaque-transparent where only the second constituent was related to the meaning of the compound (ngã lòng, translation: “disappointed”; literal meaning of the compound: “fall emotion”), and (iv) opaque-opaque where neither of the constituents was related to the meaning of the compound (bàn dost, translation: “map”; literal meaning of the compound: “copy thing”). It was predicted that if compound words went through decomposition, then the brief presentation of the compound will facilitate the recognition of the target word.

The findings of this study suggest that both HL speakers and L1 dominant participants decompose Vietnamese compound words into its morphological units irrespective of semantic transparency, and both groups do so similarly. Additionally, it seems as though both participant groups showed a stronger priming effect when the second constituent was the target (Experiment 2) than when the first constituent was the target (Experiment 1). We conclude that HL speakers seem to grammatically process Vietnamese similarly to L1-dominant speakers. This suggests that even though HL might be underdeveloped, they are processed like an L1. We will also discuss why the second constituent seems to matter more than first constituent in Vietnamese.

Evidence from Morphological Decomposition of Vietnamese Compounds

Juliet Huynh & Naoko Witzel

Grammatical Processing in a Heritage Language: Evidence from Morphological Decomposition of Vietnamese Compounds

The 11th International Conference on the Mental Lexicon

This study investigates the L2 development of the Russian case system. NN (self-identifying reference) elicited a large number of texts from adult Spanish-Catalan learners, and we selected and digitalized 196 texts by participants with A1-C1 proficiency levels, aged 18-69, and created a database that was used in this study.

Russian has six cases, three nominal declensions with several subclasses and various exceptions, three genders, and two numbers. A single ending carries information about all these characteristics. The system includes diverse patterns of morphological syncretism. The case of the noun may be determined by a verb or a preposition this noun depends on, and/or by its semantic role. We propose that some of these factors play a greater role in the acquisition of the noun case paradigms than others.

The only study on the L2 acquisition of the whole Russian case system is Rubinstein (1995), other studies focus on particular cases (e.g. Kempe & MacWhinney, 1998). Rubinstein analyzed case errors according to the principles of the Error Analysis (EA) framework (Corder, 1981), and the main criticism voiced against this framework seems to be relevant: he focused only on errors, not analyzing correct forms. He concluded that over time the quality of case errors did not change but their quantity did.

In our study, we analyzed both nouns with case errors (822 forms) and grammatically correct nouns (5980 forms). Our results show that, unlike in (Rubinstein, 1995), the quantity of case errors gradually declines along with the change of their quality.

The acquisition of different cases over time can be traced in the distribution of both correct forms and errors. At the beginner level, learners tend to overuse nominative and locative (prepositional) cases and to underuse dative, genitive and instrumental. We can explain this by the morphological complexity of genitive forms and the order of presentation in class. At the advanced level, the case system of learners shares some patterns with the system of native speakers.

Forms with errors were distributed between the following four groups: primary form (learners use Nominative case instead of any other case); case mixing (usage of incorrect case); mixing of endings within one case. The distribution of errors between the groups changes with the level of learners: the vocabulary of the more advanced learners is richer in verbs and constructions that require different cases.

It should also be noted that there were very few completely accidental case errors. The largest groups of errors were the following: (i) using accusative case on objects instead of another oblique case required by a particular verb; (ii) mixing accusative and locative used to denote direction vs. place, as in (2); (iii) relying on analogy with a synonymous verb; (iv) selecting a wrong case because of an incorrectly chosen preposition. Thus, once L2 learners move beyond the stage when they predominantly use nominative forms, nominal inflection appears to be acquired as a system.

References
Don’t Take It Out of Context: Investigating the Effects of Task Demands on Semantic Processing
Alison Heard, Andrea Protzner & Penny Pexman

13:20 – 13:40

The process by which meaning is derived from words has been described by a number of different theories. While traditional theories of semantic processing claim that concepts are retrieved through abstract symbol manipulation [1], theories of embodied cognition state that semantic processing is achieved via the recruitment of multimodal representations stored in perceptual areas of the brain [2]. More recently, hybrid theories have blended these two approaches, claiming that both lexical (amodal) and perceptual (modal) information are involved in deriving meaning from words, and the relative contribution of each is dependent on context and task demands [3]. Tousignant and Pexman [4] examined whether altering the instructions given to participants in a semantic decision task appeared to change the semantic information used to categorize each word. They compared reaction times for words that were high in body-object interaction (BOI; how easily a human body can interact with the word’s referent) to reaction times for words low in BOI. When the semantic decision was framed as “entity vs nonentity” reaction times were faster for high BOI words than for low BOI words (the well-established BOI effect). In contrast, when the decision was “action vs nonaction”, no BOI effect was observed. This behavioural finding suggested that body-based semantic information might only be accessed when relevant to task demands but did not provide resolution about the mechanisms involved; that is, in the “action vs nonaction” condition BOI information might have been accessed and ignored, or not accessed at all. In the current study we investigated the neural mechanisms underlying this modulation of the BOI effect. Participants were assigned to one of two semantic decision conditions, Action: (“Is it an action?”) or Entity (“Is it an entity?”), and completed a semantic decision task during EEG recording. The conditions were identical except for the instructions given. Behaviourally, the BOI effect was observed only in the Entity condition, replicating the results of Tousignant and Pexman. EEG results identified a significant difference in mean amplitude and rectified area of the P2 component between high and low BOI words in the Entity condition only. These results indicate that participants recruited different information in each condition, thereby suggesting that the recruitment of semantic information is a dynamic process dependent on task demands. These findings support the inference that embodied semantic information is not always processed for word stimuli but, rather, that this information is accessed as a function of task demands. These findings have implications for current theories of how meaning is derived from words.

13:40 – 14:00

Symbolic and Embodied Representations in a Deep Dyslexic
Tara Mcauley, Simritpal Malhi, Brette Lansue & Lori Buchanan

14:00 – 14:20

Do Idioms Have a Heart?
The SIDE (Sentiment of IDiomatic Expressions) Project
Lucia C. Passaro, Marco S. G. Senaldi & Alessandro Lenci

14:20 – 14:40

Why Atomism?
Roberto G. de Almeida & Caitlyn Antal

References
The 11th International Conference on the Mental Lexicon

Do Idioms Have a Heart? The SIDE (Sentiment of IDiomatic Expressions) Project

Lucia C. Passaro, Marco S. G. Senaldi & Alessandro Lenci

A sentence like John has kicked the bucket does not just mean that John has died, but it also expresses this concept in a quite informal manner, which could differ from the literal equivalent for its valence (i.e., the degree of positivity/negativity of the conveyed concept) and arousal (i.e., how emotionally intense the described event is; Lang et al. 1997, Russell 2003). A key aspect of idiomatic expressions that has been mostly left aside in previous literature is their affective value (Nunberg et al. 1994); in addition to being formally and semantically idiosyncratic (Cacciari 2014), idioms are more emotionally charged than literal expressions and are preferred by speakers when recounting emotional events (Fainsilber & Ortony 1987, Drew & Holt 1988). The aim of the SIDE project is to carry out behavioral and computational investigations on idiom sentiment and emotional content. In this first work, we collected affective ratings for a set of 45 Italian verb-noun idioms and 45 Italian non-idiomatic verb-noun pairs. Participants to two questionnaires posted on the crowdsourcing platform Figure Eight rated our targets for valence on a -3 to +3 scale (24 subjects) and for arousal on a 1-7 scale (25 subjects). Idioms were rated as significantly more negative than non-idioms (Midioms=-0.20, Mnon-idioms=-0.51, W=-3.19, p<.01) and, as expected, as significantly more arousing (Midioms=4.37, Mnon-idioms=3.48, W=9.62,p<.001). The greater negativity exhibited by idioms had already been brought to light in previous normative (Citron et al. 2016) and discourse-analytic (Drew & Holt 1988) studies, which stressed that speakers often resort to idioms when manifesting complaints. We then carried out a computational study to analyze the role of linguistic information in determining the affective rating of idioms and non-idioms. We elaborated on an existing vector-based computational model for single-word emotion detection (Passaro et al. 2015) to automatically extract valence scores for our targets. Various parameter settings were explored. Both count (Turney & Pantel 2010) and prediction (i.e., word2vec; Mikolov et al. 2013) vector representations of 300, 500 and 1000 dimensions were built for the 90 target phrases from the itWaC corpus (Baroni et al. 2009). Cosine similarity was then measured between the vector of each target and 2 centroid vectors representing positive and negative polarity. These centroids were created from vectors of nouns and adjectives associated with the 8 Plutchik’s (1994) basic emotions. In the b) case, a seed was assigned to the positive centroid if it had just been produced for SADNESS and to the negative centroid if it had just been produced for SADNESS, ANGER, FEAR and DISGUST. A unique polarity score was obtained by: a) picking the greater value between the cosine similarity of a target phrase vector with the positive centroid (POS) and its similarity to the negative centroid (NEG) and switching the sign to negative in the latter case (MAX models); b) subtracting NEG from POS (POS-NEG models). A correlation analysis...
between our polarity scores and valence ratings showed the POS-NEG model with 300-dimension Word2Vec vectors and ItEM-extracted seeds to perform the best (ρ=0.60***), especially when keeping just the 23 idioms and 19 non-idioms with an arousal value higher than the mean of each class (ρ=0.70***).

Like with human ratings, the polarity scores given to idioms were significantly lower than those given to non-idioms (W=-2.51, p<.05), reflecting their stronger negative content. These analyses suggest a role for distributional data in shaping the affect of idiomatic expressions.

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**Why Atomism?**

Roberto G. de Almeida & Caitlyn Antal

Most accounts of lexical-conceptual representation rely on analyticity. The strategies vary between lexical-semantic decomposition and the postulation of necessary inferences to related concepts. These accounts include different versions of lexical-semantic representation bearing primarily on verb-semantic templates (e.g., Jackendoff, 2002; Levin & Rappaport Hovav (2005), frames (Barsalou, 1992), and quale structures (Pustejovsky, 1995). These views have been dominant not only in linguistic accounts of meaning, but throughout cognitive science, in a variety of theoretical proposals often couched in terms of “distributed representations” (e.g., Taylor et al. 2011; McClelland & Rogers, 2003; Barsalou, 2008). The common assumption is that lexical-conceptual content is dependent on more primitive elements such as “features”. This view is committed to what has been called the analytic/synthetic (a/s) distinction (see, e.g., Rey, 2015; de Almeida & Lepore, 2018; de Almeida & Antal, in press): simply put, this distinction rests on a criterion that sets apart features that are necessary (analytic) from those that are contingent (thus, synthetic). Crucially, none of the past and current accounts of semantic representation has been able to establish a criterion for the a/s distinction, even if they all tacitly rest on its existence. Although this problem goes back to Kant’s “cleavage” between analytic and synthetic truths—as noted by Quine (1953)—of greater concern in this talk is how to conceive of lexical-semantic representations without being committed to analyticity. This issue is central to cognitive science because, among other reasons, it bears on how we represent morphological and lexical tokens, and how we form complex expressions (e.g., compounds, sentences) out of simplex ones—viz., compositionality. Ultimately a proper account of the bearers of mental content is crucial to understanding the productivity of mental representations.

This talk reviews evidence and advances arguments for the only alternative to “feature” (or molecular) theories: lexical-conceptual atomism. The main tenet of conceptual atomism is that there is a direct correspondence between lexical/morphological constituents in natural language and atomic representation at the semantic/conceptual level. Beyond Fodor’s (1998) version of atomism, the version we put forward assumes that conceptual relations—thus the elements that produce effects of feature dependency—come from quasi-logical inferences akin to meaning postulates, though they are not necessary but synthetic. Crucially, inferences are not content-constituent and do not enter into semantic composition. Three types of empirical evidence will be presented for lexical-conceptual atomism: (1) lack of decomposition effects for lexical causatives in sentence recall, thus against semantic templates for verbs; (2) an eye-tracking study suggesting early access to literal representations of lexical metaphors, thus contra theories of metaphor that postulate lexical meanings as context-sensitive feature rich representations accessed directly qua metaphors; and (3) a “memory for propositions” study suggesting that propositions faithful to literal, unenriched, indeterminate sentences linger, even in rich discourse contexts. We will present a unified account of these phenomena and suggest that despite going against “consensus”, atomism is the only way to avoid content holism, which is the antithesis of semantics.

**References**


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The current study explores whether bilinguals store their first language (L1) and second language (L2) words together or separately, and in particular, whether newly-learned L2 words are stored with L1 words or not. In order to test this, this study exploits competition between formally-similar words. In L1 literature, it has been shown that there is an inhibitory priming effect for formally-similar words (axle-ABLE) (Davis & Lupker, 2006), suggesting that these formally-similar words compete with each other. Bilingual studies have employed this technique as well to examine bilingual lexical organization. Some studies have shown competition for formally similar words across two languages (joie-JOIN) (e.g., Bijeljac-Barbic, Biardeau & Grainger, 1997). Recently, however, it was found that this competition occurs between newly-learned L1 words and established L1 words (Qiao & Forster, 2013), but such competition was not obtained between newly-learned L2 words and established L2 words (Qiao & Forster, 2017). This raises the question as to where newly-learned L2 words are stored -- in the same system as L1 words or in some other system. Native English speakers were trained over four sessions on a set of pseudo-L2 words (stafe), which were similar in form to L1 English words. Participants studied these new L2 words by learning the meaning of these words through picture association and translations, such that these new labels were matched to established meanings. Each training session ended with a masked repetition priming study in order to examine whether these participants established some kind of mental representations of these words. In the last session, the participants were also tested in a masked form priming study to test whether these new words were stored along with L1 words. Three conditions were compared -- (i) newly-learned L2 words as primes and their formally-similar L1 English counterparts as targets (stafe-STARE); (ii) formally-similar nonwords as primes (stace-STARE); and (iii) a baseline condition in which all-letter-different nonwords were used as primes (bleen-STARE). Although we predicted that these newly-learned L2 word primes would inhibit the recognition of formally-similar L1 targets when compared to the baseline condition, this was not observed. This suggests that newly-learned L2 words do not compete with formally-similar English words. We also predicted that there would be facilitatory priming for nonword primes. Nonwords do not have mental representations, so they would not compete with formally-similar English targets. However, no such priming was observed. In sum, newly-learned L2 words did not seem to interact with formally-similar L1 words despite the fact that these newly-learned L2 words showed repetition priming. Our findings seem to suggest that newly-learned L2 words are not represented along with L1 words. This was based on the finding that there was no inhibitory priming effect for newly-learned L2 word primes. Interestingly, unlike what competition-based models would predict, nonword primes did not yield facilitatory priming effects either. This makes it difficult to conclude how L2 words are stored. We will discuss this pattern of results in terms of (i) whether L2 words and L1 words are stored together, and (ii) as recent research suggest, whether there is competition in the L2 lexical system.
words had high frequency Urdu counterparts and half had low. The same was true for the low frequency English words. Thus, the stimulus set consisted of four frequency conditions High English-High Urdu, High English-Low Urdu, Low English-High Urdu and Low English-Low Urdu.

Both English and Bilinguals readers produced an English frequency effect - they responded faster to high frequency targets than low frequency target words. There was also a main effect of language experience with the Bilinguals producing longer reaction times than the Monolinguals. In addition, there was an interaction of English Frequency x Language Experience – the bilinguals produced a larger frequency effect. However, the frequency of the Urdu word counterpart did not influence the word recognition performance for the target English word for the bilinguals.

The current study provides the first evidence for the effect of word frequency on the relationship of lexical entries between the primary and secondary language. The Frequency x Language Experience interaction can be explained by models that assume that L2 words generally have lower resting-level activations than do L1 words of the same corpus frequency due to differences in proficiency levels (Dijkstra & Van Heuven, 2002). The absence of the cross-language frequency differential effect is inconsistent with models proposing non-selective access in bilinguals because the frequency of a word in one language (L1) did not influence lexical access of the same word in the other language (L2).

References


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Differences in Native and Non-native Lombard Speech Production and Perception
Katherine Marcoux, Elisabeth Süß & Mirjam Ernestus

Non-native speakers are confronted with a higher cognitive load [1]. It is possible that speaking in a non-native language further requires higher cognitive load in non-ideal environments, for instance a noisy one, which elicits Lombard speech. Lombard speech is characterized by certain key features (e.g. increase in fundamental frequency (pitch) and intensity and a decrease in spectral tilt) [2]. If the production of Lombard speech requires more cognitive resources, non-native speakers have fewer resources to produce it. Moreover, knowing that they may be hard to be understood in a noisy environment, non-native speakers could make a greater effort to articulate the phonemes that they know are difficult for them. In this study, we investigated the difference between native and non-native Lombard speech production and how this affects the way their speech is perceived by native speakers.

We conducted a production study in English, on which we then based a perception study. For the production study, we had three categories of keywords which Dutch speakers of English have difficulties with. The first category involved keywords with /θ/ (e.g. theory /ˈθɪri/) , a phoneme that does not exist in Dutch. Dutch learners of English are made aware of this from very early on. The second category had words that ended in /b,d/ (e.g. road /roʊd/). Dutch speakers are not conscious of final devoicing in their language, in which the final /b,d/ is pronounced like /p,t/, and hence they will not realize that they are prone to carry over this tendency into English. The third category included English-Dutch cognates with a schwa orthographically written as a full vowel (e.g. balloon /boˈluːn/). Dutch learners of English are not aware that most of these vowels are pronounced as a schwa in English, as both the full vowel and schwa are acceptable in Dutch.

Keywords were embedded in question-answer pairs in focus (F) and off focus (NF) position, which were read by 30 native Dutch and 8 native American-English speakers. This was done in a quiet environment (quiet condition) and in a noisy environment, listening to Speech Shaped Noise at 82 dB SPL through headphones (Lombard condition). Acoustics of the recorded speech will be analyzed by September, which will reveal differences between native and non-native Lombard speech characteristics.

The perception experiment consisted of 36 native American-English speakers determining whether keywords sounded more native-like in the two extreme conditions: in the focus Lombard (FL) or in the non-focus quiet (NFQ) condition. The listeners rated both native and non-native speech. A linear mixed effects model in R revealed that overall, listeners rated the keywords in the NFQ condition as more native-like than in the FL condition. The effect of noise was greater for the native than the non-native speakers. The listeners rated the NFQ keywords as more native-like than the FL keywords in 72% of trials for the native speech and in 52% of the trials for non-native speech. The non-native speakers thus seem to have hardly changed their pronunciation in the noisy condition. This may be because non-native speakers face a higher cognitive load, allowing for less cognitive resources to adapt their speech to the noisy environment.
Additionally, we found that the /θ/ word category showed the reverse pattern, being rated as more native-like in the FL than in the NFQ condition. Examining the data suggests that especially the non-native speakers’ /θ/ words were rated as more native-like in the FL condition compared to the NFQ condition. We believe that the Dutch speakers were aware of the difficulty with /θ/ and made the extra effort to pronounce it well in Lombard speech, sounding more native-like.

The perception experiment sheds light on the differences in native and non-native production of Lombard speech which may be due to extra cognitive load in non-native speakers. The combination of the results from the production and perception studies provides a holistic picture of the nature of non-native Lombard speech.

Lexical Relations in Two Groups of Mexican Elderly

Deviani Bonilla & Natalia Arias Trejo

The main objective of this study is to analyze the type of relationship generated by older adults in a word association task. Studies with aging population are usually compared with young adults, for example, Hirsh & Tree (2001) found a greater number of paradigmatic responses within the group of older adults, as well as Lovelace & Cooley (1982).

However, there is evidence that significant cognitive changes occur at the same time as those already present (for example, deficits in working memory) as of the eighth decade of life (Baltes & Smith, 2003). The work of Navarro-González y colleagues (2015) found no differences in the verbal performance of 64 elderly people in a 4-year longitudinal study. Therefore, the present investigation intends to make a study in two groups of older adults in order to know if the type of lexical association with respect to the grammatical class changes at very advanced ages.

A task of word association with 123 stimuli was applied through a computerized program to 26 older adult participants -13 participants of 60-76 years M = 69.6, and 13 of 80-97 years M = 84. Following Lovelace & Cooley (1982) the proportion of paradigmatic, syntagmatic, indeterminate and miscellaneous relationships were analyzed. A greater number of paradigmatic responses were found in both groups of participants, the same dynamics of association between groups were encountered which reveals a maintenance of access to mental lexicon strategies in very old age.

Numerals Beyond Language: When Word Usage is Governed by Psychophysical Laws

Marco Marelli & Luca Rinaldi

It has been suggested that our understanding of number words can be traced back to an evolutionarily-ancient approximate number system, which represents quantities on a compressed scale and adheres to psychophysical principles such as the Weber’s law (Gallistel & Gelman, 1992). However, due to its pre-verbal nature, such a system should be expected to impact not only the comprehension of numerals, but also their production. The present work tests this hypothesis in a computational semantics framework.

In order to quantitatively characterize the usage of numerals in natural languages, we applied distributional semantic models (Landauer & Dumais, 1997 to data from large-scale corpora. In particular, we adopted a state-of-the-art word-embeddings approach (Mikolov et al., 2013). Such systems induce word meanings in terms of vector representations based on linguistic distributions. We considered representations for numerals ranging from “two” to “twenty”, and evaluate their pairwise associations. These were characterized through a combination of three model-based parameters: cosine between the vector representations involved (e.g., cosine between the “three” vector and the “seven” vector), and vector variance for both elements (e.g., variance of the dimensions of the “three” vector and variance of the dimensions of the “seven” vector).

We show that the associations between model-based representations mirror the ratio between their corresponding quantities, rather than the distance. For example, the difference in behavior between the language-induced representations of “two” and “six” is similar to the one observed for “three” and “nine” (whose corresponding quantities have the same ratio, 1/3), rather than “three” and “seven” (whose corresponding quantities have the same difference, 4). This evidence is a clear signature of Weber’s law, and perfectly mirrors the human (Moyer & Landauer, 1967) and non-human (Nieder & Dehaene, 2009) performance in comparative judgments of numbers, as observed in experimental studies. We describe the same effect for a range of different languages, including a constructed language like Esperanto.

Together, these findings imply that the everyday use of numerals rests upon a pre-verbal approximate number system. They also remarkably indicate that, in principle, humans can grasp the meaning of number words only from language statistics and, thus, independently of any perceptual input.
The way in which we access word semantics in different priming paradigms is the object of investigation of the present study. Here we propose two consistency measures, based on distributional semantics methods, which individuate dissociating paths of semantic activation in morphological masked priming vs. semantic priming.

The principal hypothesis of our comparison is that the different time structure of the paradigms affects the quality of the information that directs semantic activation. We therefore relied on two consistency measures that formalize pattern of semantic activation based on form-meaning mapping and semantic density to predict priming magnitude on data taken from five published morphological masked priming studies, and on the Semantic Priming Project (hence, SPP; Hutchison et al., 2013) - both dataset based on a lexical decision task. The Orthography-Semantics Consistency (OSC) is a measure of how easily the meaning of a given word can be accessed from its form. OSC is computed as the frequency-weighted average semantic similarity between the meaning of a given word and the meanings of all its orthographic relatives, that is, all the words containing that very same orthographic string (Marelli & Amenta, 2018). In constrast, the Intra-Semantics Consistency (ISC) is operationalized as the frequency-weighed semantic similarity between the meaning of a word and those of its top 30 semantic neighbors, and it focuses on relationships within the semantic network of the target.

In Experiment 1, we focused on OSC. In masked morphological priming, the orthographic word-set on which OSC is computed is constituted by words that could all in principle be used as primes, and the contribution to OSC of each orthographic relative is determined by its frequency. It follows that, as straightforward prediction of the algorithm, priming magnitude should be modulated by an interaction between OSC and prime frequency. The analysis showed indeed that the impact of the prime is crucially qualified by its frequency in the semantic cohort activated by the target orthography as captured by OSC confirming a role for semantics already at early stages of visual word recognition (as captured by masked priming paradigms).

However, the activated semantic network is crucially informed by the orthographic information associated to the word. Turning to semantic priming, we showed that, crucially, the effect of OSC fails to appear, indicating that it could be specific to masked conditions.

In Experiments 2, we tested the hypothesis that, although the effect of OSC on priming must be specific to masked condition, the same approach (i.e., semantic consistency) might be used to describe semantic activation also in semantic priming. We used now ISC as predictor of priming magnitude. Specifically, we tested the interaction between target ISC and prime frequency again on both datasets. While the interaction between prime frequency and ISC was not significant on masked priming data, it was significant on semantic priming data.

The double dissociation between measures and priming paradigms shows that different priming paradigms are indeed associated with the activation of different cohorts. While in masked morphological priming the orthographic form determines the activation of the semantic cohort of the target, i.e. semantic activation is informed by orthographic information, in semantic priming the focus is on how words are connected to each other, and higher level intra-semantic relationships drive the effects observed on behavioral data.

References

Processing Compounds: What Frequency (Alone) Cannot Explain
Vito Pirrelli, Marcello Ferro, Claudia Marzi, Christina Gagné, Thomas Spalding & Marco Marelli

Observed elevation in typing latency for the initial letter of the second constituent of an English compound, compared with the typing time of the final letter of the first constituent (Gagné & Spalding 2016), suggests that both compounds (snowball) and pseudo-compounds (carpet) are decomposed but also that full form representations are available in the lexical store. To gain further insight into the lexical representations underlying typing, we used computational modelling. In particular, we used superpositional models of word memory, based on Self-Organising Recurrent Maps (TSOMs) (Ferro et al. 2016; Marzi et al. 2016), where both simple and compound words are processed (and stored) using the same pool of processing (and memory) resources, to model the elevation in typing time at the constituent boundary and the rate of typing. In addition, we also considered models based in the Compositional Distributional Semantics framework (CAOSS, Marelli et al. 2017), to simulate independent effects of semantic transparency on compound typing (Gagné & Spalding 2016).

Is Inflectional Irregularity Dysfunctional to Human Processing?
Claudia Marzi, Marcello Ferro & Vito Pirrelli

Regularly inflected verb forms are classically associated with the formal transparency and predictability of their internal constituents. Transparency ensures that full forms can be segmented uniquely into their internal constituents: as in walk-s/walk-ed. Predictability allows for a speaker to fill in an empty paradigm cell, using information from other known forms of the same lexical paradigm and its inflection macro-class. From this perspective, irregulars appear to be dysfunctional to the human processing system, as they make it hard to infer - say - bought from buy, or segment bought appropriately into its constituent parts. Likewise, an influential psycholinguistic tradition relegates irregulars to the lexical store, whereas regulars are segmented by rules into their simpler constituents.

Here, we offer a few reasons for questioning this view. First, transparency and predictability are not dichotomous notions. Secondly, their influence on processing is not unidirectional. Unpredictable stems in irregularly inflected forms of complex inflectional systems provide a lot of processing information, by dynamically constraining the number of possible alternative endings during serial processing. Thirdly, acquisition of word inflection does not consist in associating co-occurring cues and outcomes, but in discriminating between multiple cues that are constantly in competition for their predictive value for a given outcome.

Surviving the Intervention: ERPs and Masked Intervenor Priming
Jeffrey Witzel, Naoko Witzel, Ehsan Shafiee Zargar & Kenneth Forster

According to Forster and Davis (1984), the entry-opening model of lexical access posits that there are two distinct levels of lexical information -- a form level and a meaning level. Consistent with this model, the results of recent experiments involving masked priming across intervening stimuli (Forster 2009, 2013) indicate that these two levels of information are indeed dissociable during visual word recognition. One of the key findings from these experiments is that masked identity priming is reduced, but not eliminated, when there is an intervening (unrelated) masked prime (e.g., bathroom-enthrall-BATHROOM). However, when this other masked stimulus is presented immediately prior to the prime and its target (e.g., enthrall-bathroom-BATHROOM), standard levels of identity priming are obtained. These results have been interpreted to indicate that the masked intervenor initiates a new lexical search, thus stripping away the ability of the identity prime to influence the processing of the target at the form level. Under this account, reduced identity priming occurs in this case because the prime influences the processing of the target only at the semantic level.

The present study tested this account by examining event-related potentials (ERPs) during masked intervenor identity priming. Previous research has indicated that masked identity priming is associated with a reduction (relative to an unrelated control condition) in two main ERP components -- the N250 and the N400 (Holcomb & Grainger, 2006). This is important because the N250 has been interpreted to index relatively early form-level processing (e.g., the matching of letters to word representations; Grainger & Holcomb, 2009), while the N400 has been associated with meaning activation (Kutas & Federmeier, 2011). It was therefore predicted that when the masked identity prime was adjacent to the target (enthrall-bathroom-BATHROOM), there would be a reduction in both of these components. However, when the masked identity prime was presented non-adjacent to the target -- i.e., when there was an intervening (unrelated) masked prime (bathroom-enthrall-BATHROOM) -- it was predicted that only N400 effect would obtain.

Two experiments were conducted. Experiment 1 (N = 32) provided a behavioral replication of previous masked inter-
venor identity priming effects. Consistent with these findings, while both the adjacent and non-adjacent conditions yielded significant identity priming, this effect was larger for the adjacent condition (43 ms) than for the non-adjacent condition (44 ms). Experiment 2 (N = 20) tested the same priming conditions while recording participants’ neurophysiological responses with electroencephalography. The behavioral results from this experiment again yielded reliable identity priming effects for both prime positions, with a larger priming effect for the adjacent condition (40 ms) than for the non-adjacent condition (23 ms). Furthermore, as predicted, identity priming under the adjacent condition was associated with reduced N250 and N400 ERP components. Under the non-adjacent condition, on the other hand, identity priming modulated only the N400 component.

These results are interpreted as additional support for the entry-opening model of masked priming -- and of lexical access more generally. Under this model, form and meaning information are represented and retrieved separately, so it is not surprising that meaning-based identity priming can occur even in the absence of a form-related effect. The findings of this study will be discussed with reference to this model as well as to the challenges they pose for activation-based models of masked priming, under which priming effects depend on persistent activation from the prime (e.g., Davis, 2003).

ReadLet: An ITC Platform for the Assessment of Reading Efficiency in Early Graders
Marcello Ferro, Claudia Cappa, Sara Giulivi, Claudia Marzi, Franco Alberto Cardillo & Vito Pirrelli

Reading is not just word decoding, but the joint product of decoding and deep linguistic comprehension. Effective linguistic comprehension relies on language skills such as semantic and syntactic awareness. Both decoding and linguistic comprehension are necessary for reading comprehension, and neither is by itself sufficient. However, current protocols for reading assessment measure decoding (reading accuracy and speed) and reading comprehension separately. This does not allow evaluation of reading efficiency, defined as the ability to fully understand connected texts by minimising reading time, a cognitive ability that lies at the roots of students’ academic achievement. ReadLet is an ICT platform specifically designed to provide accurate, evidence-based assessment of reading efficiency in early grade children, by offering an ecological, non-invasive protocol for extensive data elicitation, storage and analysis.

Iconic Word Recognition
David Sidhu, Gabriella Vigliocco & Penny Pexman

Many models of word recognition propose that meaning is accessed via two routes: directly from a word’s orthography, and indirectly from its orthography via its phonology (e.g., Harn & Seidenberg, 2004). Importantly, the extent to which either path is used varies depending on task context. For instance, phonological variables (e.g., spelling-sound regularity; Hino & Lupker, 1996) play more of a role in word recognition tasks when the orthographic-phonological route is prioritized. One possibility that has not been explored is that certain links between phonology and semantics may be stronger than others. Here we refer to so-called iconic phonological-semantic mappings (Perniss, Thompson, & Vigliocco, 2010): instances in which the sound of a word resembles its meaning directly via imitation (e.g., onomatopoeia such as hoot) or indirectly via associations evoked by phonology (e.g., zigzag, whose alternating vowels evoke the changes in movement to which the word refers). It is possible that such mappings are special and in fact facilitate the access of semantics via phonology. This should be especially apparent when a task prioritizes the orthographic-phonological route.

Apart from ideophones (a grammatical class of marked iconic words not common in English; see Dingemanse, 2018), research on the effects of iconicity on language processing has been scarce (cf. Meteyard et al., 2015). Nevertheless, Perry, Perlman and Lupyan (2015) asked participants to rate a large set of English words on their iconicity and discovered that words existed along the entire spectrum. The purpose of the present research was to examine whether this general form of iconicity (i.e., not restricted to a specific grammatical category) would affect language processing. In order to explore the possibility that iconic effects are due to special links between phonology and semantics, we did so using tasks that varied in the extent to which they involved phonology. Experiment 1 involves a lexical decision task with 40 non-iconic words, 40 directly iconic words (e.g., hoot), and 40 indirectly iconic word (e.g., zigzag; based on Perry et al., 2015). Importantly, half of the participants will take part in a version of the task in which the stimuli are visually degraded. Past research has shown this to emphasize phonological processing (e.g., Hino & Lupker, 1996). If the special links between phonology and semantics in iconic words facilitate processing then we would expect their processing to be facilitated, especially to the extent that phonology is prioritized (i.e., in the degraded condition). Our target for this experiment is 80 participants; data collection thus far (N = 44) reveals a trend in which directly iconic words are processed faster than non-iconic words in the degraded condition. Experiment 2 involves a phonological lexical decision task: participants are asked whether presented letter strings sound like real words. Importantly, the stimuli for this task include pseudohomophones (e.g., hawp, a pseudohomophone of hop), which sound like real words but are not real words. Thus
participants cannot respond based on a letter string’s status as a real word alone, and must consider phonology in order to respond correctly. Our target for this experiment is 40 participants; data collection thus far (N = 24) reveals a trend in which both directly and indirectly iconic words are processed faster than non-iconic words.

Repetition blindness (RB) is the failure to detect or report repetitions among a series or display of items that are presented visually and rapidly (Kanwisher, 1987). Debate exists in the literature on whether phonological identity itself contributes to RB (Bavelier & Potter, 1990) or if RB occurs for homophones only when there is orthographic similarity (Kanwisher & Potter, 1990). Additionally, grouping of items has been found to reliably prevent RB (“survival of the grouped”) in nonlinguistic stimuli (dots and slashes, Goldfarb & Treisman, 2011) and variably prevent RB in linguistic stimuli (words, Jackson & Buchanan, 2016), with the most consistent effect found when items were grouped by case. The aims of this study were to 1) establish whether heterographic homophones could elicit RB and 2) determine whether such homophones could be perceptually grouped to produce a survival of the grouped effect. Homophones were placed among distractors in brief simultaneous visual displays (BSVP) where words were presented either all in lower case or grouped by lower vs. upper case. This 2 x 3 within-subjects design included display as one factor (grouping based on case vs. all lower case), and number of target homophones as another factor (one, two, or three).

Fifty-one undergraduate psychology students participated in this experiment, with data from 30 (Sex: F = 26, M = 4; Age: M = 21.13, SD = 3.13) used in analyses. Twenty-one participants performed below the cutoff of 35% accuracy for one target presentation on both the displays. Results revealed RB for two and three homophones in the all lower case display, F(2,58) = 23.51, p < .001, η² = 0.45, such that a difference was found between one and two (p = .003), one and three (p < .001), and two and three (p = .007) target presentations. For the display that was perceptually grouped, repetition blindness was found, F(2,58) = 10.57, p < .001, η² = 0.27, at two (1 vs. 2, p < .001), but not three homophones (1 vs. 3, p = .068; 2 vs. 3, p = .405), suggesting survival of the grouped. At two presentations, the display that was perceptually grouped had greater RB than the all lower case display, t(29) = 2.98, p = .006. The main findings support the notion that phonological identity contributes to RB but homophones can be grouped to reduce RB in the context of a perceptual grouping principle.

Information about syntactic and morphological family category membership is recoverable from word co-occurrence statistics (e.g., Baroni and Zamparelli, 2010; Mikolov, Yih, & Zweig, 2013; Ling, Dyer, Black, & Trancoso, 2015; Drozd, Gladkova, and Matsuoka, 2016). However, this fact has not been accompanied by any compelling evidence that co-occurrence models learn about or represent word class information in any way relevant to human language processing. That would require that co-occurrence models make specific predictions about human behaviour that would be difficult to make or explain by other models. We report on four experiments that make and confirm such predictions.

We test the prediction that humans represent syntactic categories as continuous categories derived from linguistic experience. Using the skip-gram model (Mikolov, Chen, and Corrado, 2013), we derive continuous measures of how noun-like and how verb-like a word is. In a series of four go/no-go experiments that required participants to decide if a word belonged to a specific syntactic category, we demonstrate that these measures predict response times to verb and noun category decisions.

Together these studies examine an aspect of language that is not taken into consideration by existing word recognition models: the possibility that some links between phonology and semantics (i.e., iconic mappings) are inherently stronger than others, and that these facilitate lexical processing.
Episodic memory involves the representations of single events and the associations between events (Schacter & Graf, 1986). The later type is called associative memory and it is important because our entire knowledge network is based on associations between individual units of information; for example, we learn the associations between words and their meanings and between events and their contexts. Both differences and similarities have been found between single-item and associative memory; for instance, rate of forgetting has been found to be greater for single words than for associations but depth of processing influences both types of memory in a similar way (Hockley & Consoli, 1999; Schacter & Graf, 1986).

A previous study found that semantic neighbourhood density (SND) influences memory for single words (Wong Gonzalez & Buchanan, 2018). Specifically, high SND words were remembered better than low SND words in both explicit and implicit memory tasks. SND is a measure of how word representations are organized and connected to each other in semantic space, and it represents the variance in distances in semantic space between the target and its neighbors (Buchanan et al., 2001). The objective of the present study was to examine whether the observed effects of SND on memory for single words extend to memory for associations. We present data from two tasks in which participants studied a list of word pairs. The experimental word pairs were constructed using semantically unrelated nouns that were either high or low in SND (WINDSORS; Durda & Buchanan, 2008). Associative memory was tested with either a yes/no recognition memory task to examine explicit memory or a lexical decision task to examine implicit memory.

We found that word pairs with two high SND words were remembered better than other pairs in the explicit memory task. We also found that word pairs with two high SND words had a larger priming effect than other pairs in the lexical decision task. These results indicate that high SND words facilitate both explicit and implicit associative memory. Associations between two words with many close semantic neighbors are remembered better than those between words with few close neighbors. These results are consistent with previous research which found that high SND facilitated memory for single words (Wong Gonzalez & Buchanan, 2018). These findings reveal that the distribution of semantic neighbors is an important factor that influences retrieval of newly formed word associations.

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This archival analysis was conducted to explore the relationships that computationally derived measures of semantic similarity and semantic richness have with subjective measures of semantic transparency across lexemes of English compound words, as well as with behavioural measures. This study examined relationships between transparency classification (Libben, 1998), participant ratings of transparency and lexeme meaning dominance (Juhasz, 2013), and computationally derived measures of semantic association (Durda, 2013, Durda & Buchanan, 2008). Further, the ability of these constructs to predict lexical decision performance was considered using data from the English Lexicon Project (Balota et al., 2007).

The research questions guiding this study can be summarized broadly as follows: 1) How do various methods of quantifying intralexical semantic relationships interrelate in English compound words? 2) How do these measures relate to measures of semantic richness in English compound words? 3) Do these variables correlate with archival behavioural measures in English compound words? And finally, 4) Do intralexical differences in semantic richness have an effect on the processing of English compound words? Analyses of variance and correlational analyses revealed mean differences and relationships between computational measures and participant rated measures, suggesting that computational
The objective of the present study was to identify predictors of successful reading development in an eight-month (26 week) intensive ESL program. We report two within-participant eye-movement studies of reading (Study 1, n = 31; Study 2, n = 89) in which Mandarin and Cantonese university-level learners of English were tested at the beginning (t1) and end (t2) of an instructional program of English. In each study we sought to identify (a) what components of reading behavior would be most affected by L2 instruction; (b) what individual skills at t1 contribute to outcomes in reading proficiency at t2; and (c) what skills developed between t1 and t2 are most strongly associated with individual gains in reading proficiency. We recorded eye-movements as participants silently read passages of varying complexity for comprehension at the beginning and end of the ESL program. In addition, key component skills of reading (e.g., phonological processing, expressive and receptive vocabulary knowledge, reading comprehension) were measured with standardized tests at t1 and t2. Additional information was gathered, such as the IELTS scores of participants before entering the instruction program. Pilot results (Study 1) show that the greatest change across time-points occurred for late eye-movement measures to words (total reading time and regression rate). We interpret this as indicative of gains made in later cognitive processing stages of word recognition, where higher order processes of reading comprehension occur, such as semantic integration and ambiguity resolution. Moreover, the greatest developmental gains in reading skill (gauged via eye-movements) were found in individuals with the strongest English speaking skill at t1, as well as students with the greatest growth in vocabulary from t1 to t2. We discuss the behavioral trajectory of reading development and the implications of individual learner differences in second language literacy acquisition.

A limitation of semantic norms is that they are synchronic, representing language use at the time they were collected. Yet, clearly meaning changes: terrific is now a positive word, derived from the same root as terrible. Studying meaning change over time offers important insights into the nature of the mental lexicon, the evolution of language, and the evolution of culture. What about less studied semantic dimensions, such as concreteness? How have words changed in concreteness over time? Creating diachronic concreteness norms requires computational extrapolation; existing concreteness norms gathered from human subjects have a temporal scope of a mere 45 years, covering only a small amount of the lexicon.

We utilize an unsupervised semantic norm extrapolation tool (Hamilton, Clark, Leskovec, & Jurafsky, 2016) and the Corpus of Historical American English (Davies, 2010-) to create historical concreteness norms for the decades 1850 to 2000, and explore aggregate and word-specific trends in change in concreteness. We also make our historical concreteness norms and the data used to create them available for others to study. While we use the Hamilton et al. (2016) method for historical concreteness norm extrapolation, the method can be applied in cases where specialized (i.e. adapted to a time period, genre, or specific group of speakers) semantic norms are desired, and a valid corpus from which to derive those norms is available.

We utilize a simple and powerful approach for extrapolating historical semantic norms created by Hamilton et al. (2016). This method extrapolates continuous semantic norms for words by running two random walks over a graph with words

Semantic neighbourhood density of both the whole word and the second constituent were positively correlated with both decision times and accuracy in the archival lexical decision data. Further, an increase in semantic richness of the whole word relative to its constituent parts was related to greater accuracy. This accuracy advantage was particularly salient in fully opaque compound words, suggesting that the semantic richness of constituents may play an inhibitory role in a word’s correct identification and that this effect is greater when the constituents are not semantically related to the whole word. The results of these exploratory analyses are interpreted as providing support for an attractor dynamics model (i.e. Mirman & Magnuson, 2008) of compound processing.

Determinants of Successful Reading Development in L2 English Learners: A Within Participant Eye-movement Study
Daniel Schmidtke, Amy-Beth Warriner & Anna Moro

Generating a Historical Concreteness Lexicon
Bryor Snefjella, Michel Genereux & Victor Kuperman
A typical N400 event-related potential (ERP) component occurs when the brain detects a contradiction and can be elicited by the canonical experiment where the end word of a sentence contradicts what a listener is expecting to hear (Kutas & Hillyard, 1984; Kutas, & Federmeier, 2011). Through an extensive literature search and thorough inquiries through the French ERP research network, the research team has determined that an adequate version of Canadian French sentences designed to elicit N400 responses does not exist, which severely limits the use of this paradigm with French-speakers from the province Québec and elsewhere in Canada. While English sets of sentences exist, they cannot be directly translated into French; rather, the French sentences must be created and validated to match the characteristics of Canadian French. The overall goal of this study was the development and validation of a Canadian French N400 ERP component elicitation paradigm.

Methodology: N400 stimulus development occurred in two phases. In Phase 1, we created 100 sentences (50 with congruent and 50 with incongruent word endings). A different final word was selected for each sentence and was controlled for the following psycholinguistic variables: frequency of occurrence, length, phonological structure, imageability, and number of phonological neighbours (Omnilex database, University of Ottawa). Surveys were administered to French-dominant speakers from the Montréal area. One survey tested the semantic plausibility of 100 the newly created sentences. Participants were asked to rate the semantic plausibility of each sentence on a 1-5 rating scale (“1- the sentence is completely logical” to “5- the sentence is completely illogical”). The second survey determined the cloze probability of the same 100 sentences by asking participants to fill in the expected last word. A total of 146 healthy dominant French-speaking adults aged 18-88 completed a survey (n=70 semantic plausibility; n=76 for cloze probability). Congruent sentences were included in Phase 2 if 1) 80% or more of participants gave a semantic plausibility rating of 1 or 2 and 2) the cloze probability for the target word was equal to or exceeded 80%. Incongruent sentences were included if 1) 80% or more of participants gave a rating of 4 or 5 and 2) the cloze probability of the target word was 0% and but participants entered another word that reached 80% or more cloze probability. To test whether the sentences could elicit a N400 component, 40 exemplars of each sentence type were tested in Phase 2 with 20 healthy dominant French-speaking adults aged 18-79. High-density EEG (128 channel) was recorded as the 80 sentences from Phase 1 were presented aurally in random order. Participants were asked to minimize movement and to decide whether each sentence ‘made sense’ by making a yes-no button press response. Analysis: EEG was segmented 200 milliseconds (ms) before and 800ms second after each end word. Data from electrodes Cz, Pz and Oz was averaged across congruent and incongruent sentences. Serial t-tests were used to identify significant deviations in the waveforms. Results: The differences in the waveforms revealed a significant N400 in parietal areas generated by the incongruent sentences, demonstrating the ability of this paradigm to elicit the desired brain response. Conclusion: We propose that the newly created Canadian French N400 event-related potential paradigm can be used to successfully elicit the N400 in dominant French-speaking Canadian healthy adults thus permitting the use of the N400 paradigm with this population and complementing data that has been collected in other languages.

References
A metaphor, such as language is a bridge, juxtaposes two unrelated concepts (a topic and a vehicle) to produce figurative meaning. Traditionally, the vehicle (e.g., “bridge”) is assumed to convey information to the topic (e.g., “language”) that provides the basis for interpretation. In psycholinguistics and cognitive psychology, the bulk of metaphor research is focused on the semantic processing mechanisms underlying comprehension (e.g., Glucksberg, 2008; Kintsch, 2008; Wolff & Gentner, 2011). Consequently, metaphor production, and its underlying semantic processing mechanisms, has been mostly ignored in the literature. One exception is Katz’s (1989) study, in which participants were asked to choose vehicles to complete metap- horic sentence frames (e.g., Switzerland is the ______ of nations). Katz found two semantic effects; first, concrete vehicles were chosen more than abstract vehicles and second, that the vehicles chosen were a moderate semantic distance from the topic. However, little more has been done to characterize the semantic properties of concrete vehicles in metaphor production. Moreover, although Katz considered semantic distance, he did not consider semantic neighbourhood density, a variable known to be influential in a number of cognitive tasks (Danguecan & Buchanan, 2016).

In the current study, participants created metaphors by choosing a vehicle for abstract topics, with potential vehicles (all concrete) presented in lists that differed in semantic neighbour- 
hood density (SND) and body-object interaction (BOI). All of the topics were abstract but half were high-SND (from dense semantic neighbourhoods) and half were low-SND (from sparse semantic neighbourhoods). Similarly, half of the potential vehicles were either high or low in SND. The vehicles also differed on body-object interaction (BOI), which reflects the ease which one can physically interact with a word’s refer- ent (Siakaluk et al. 2008). Half of the vehicles were high-BOI 
words, such as bicycle, whereas half were low-BOI words, such as rainbow. In each trial, participants were presented with an abstract topic, such as miracle, and were instructed to make an apt comprehensible metaphor. The frequency of vehicles 
chosen was analyzed in a three-way ANOVA (topic-SND X vehicle-SND X vehicle-BOI).

A main-effect of BOI revealed that low-BOI vehicles were chosen more than high-BOI vehicles. A BOI by SND interaction revealed that the low-BOI preference was greatest when the vehicle was low-SND. Lastly, a topic-SND by vehicle-BOI interaction revealed that for high-SND topics, participants relied the most on low BOI – low SND vehicles to construct apt metaphors. Conversely, for low-SND topics, vehicle SND does not interact with BOI. In short, our results show that semantically poor words are chosen to create metaphors more-so than semantically rich words. We interpret our results as consistent with models that consider semantic richness to be detrimental for metaphor processing (e.g., Al-Azary & Buchanan, 2017).

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On Choosing the Vehicles for Metaphors 2.0: 
Body-object Interaction and Semantic Neighbourhood Density 
Hamad Al-Azary & Albert Katz

One under-researched cognitive ability that affects reading is statistical learning. Statistical learning refers to the brain’s ability to notice and use re-occurring patterns in the environment to predict and process upcoming information. The influence of statistical learning on language has been seen at many different stages of L1 and L2 acquisition and use (Saffran, Aslin, & Newport, 1996; Mintz, 2003; Arciuli & Simpson, 2012; Frost & Siegelman, 2013). Our study aims to further investigate this relationship by focusing on the interaction between statistical learning and reading abilities in English and Hebrew. Specifically, this study looks into how various components of statistical learning map onto reading and how language statistics modulates this relationship. Statistical learning has been demonstrated in at least two aspects: learning of distributional patterns (how often does an item occur in the input) and transitional patterns (how likely is item A to be followed by item B). These types of learning readily map onto different types of linguistic information: distributional (frequency of occurrence of a lexical, morphological or syntactic unit) and transitional (predictability of a unit given

Investigating the Relationship Between Reading and Statistical Learning in English and Hebrew 
Kelly Nisbet & Victor Kuperman

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Words can be described along different affective dimensions, for example, from very negative (e.g., murder) to very positive (e.g., puppy); from very exciting (e.g., panic) to very calming (e.g., sleep); from extremely dangerous (e.g., lion) to not dangerous at all (e.g., echo); and from extremely useful to human survival (e.g., knife) to not useful at all (e.g., scorpion). Previous studies have had participants rate words on different dimensions (e.g., Wurm et al. 2007; Warriner et al., 2013) and used the average ratings to predict subsequent language processing. It has been shown that affective properties of words influence lexical processing (Estes & Adelman, 2008; Kuperman et al., 2014; Larsen et al., 2008). For instance, positive, calming, useful and dangerous words have been found to elicit the fastest reaction times in word recognition tasks (Kuperman et al., 2014; Wurm, 2007). However, it is not clear how the affective properties of word components and how individual differences between raters, such as personality, influence affective ratings for complex words.

In our study, 181 native speakers of English (123 females; Mage=20 years) rated 450 words, including monomorphemic (fur), derived (furry), inflected (furs), pseudo-complex (fury) and stem-embedded words (furl). 25% of the participants rated words on the valence scale (1-happy; 9-sad), 25% on the arousal scale (1-exciting, 9-calm), 25% on the danger scale (1-dangerous, 9-not dangerous), and 25% on the usefulness scale (1-usefulness, 9-not useful). In addition, participants filled out a language background and Big Five personality questionnaire (John & Srivastava, 1999).

First, we investigated the relationship between the whole complex word and its stem ratings. Across different ratings, we found that the stem was most correlated with the whole word ratings for inflected words ($R^2=0.6$), followed by derived ($R^2=0.4$), pseudo-complex ($R^2=0.3$) and stem-embedded words ($R^2=0.2$). Interestingly, there was a stronger relationship between stem and whole-word ratings for usefulness and danger ratings than for valence and arousal ratings. Furthermore, using ordinal GAMMs (Baayen and Divjak, 2017), we found that personality scores were significant predictors of participants’ ratings, neuroticism being the most consistent predictor across the five personality dimensions. For instance, participants scoring high on neuroticism scale rated words as most dangerous ($z=2.14, p=0.03$). Neuroticism also entered into an interaction with stem ratings. Complex words with higher stem ratings were evaluated less useful, more dangerous, exciting, and negative by highly neurotic participants.

In summary, we found a relationship between stem ratings and whole-word ratings. However, this effect was different depending on the type of word and the affective dimension, suggesting that stem is more important to evolutionarily based scales than scales which are more related to person’s subjective life experience, such as valence. Finally, in addition to word characteristics, individual differences between raters, i.e. personality differences, influence word ratings. All these aspects should be taken into account when working with ratings of morphologically complex words.
Introduction. Dyslexia is a common learning disability that affects 5-12% of children worldwide 1. In addition to the compromised reading skills, individuals with dyslexia also face lifelong difficulties with spelling 2. Spelling is described as the production of the written language in response to the auditory or self-generated thought. Research shows that individuals with dyslexia have poor implicit awareness of phonology, orthography and morphology, which contributes to their impaired spelling performance 3,4. However, there is no consensus as to where the majority of deficits are present and whether these deficits impact their spelling. In this work, we studied implicit awareness of these skills in skilled and impaired readers and explored the nature of their spelling errors. This will increase our understanding of the underlying basis of and the potential remediation approaches for, spelling impairments in dyslexia. Methods. 19 skilled and 15 individuals with dyslexia performed four standardized reading tests and three language measures to test their phonemic, orthographic and morphological awareness. In addition, they completed the spelling dictation task from Wide Range Achievement Test-4th Edition. Analyses. Independent samples t-test were run for accuracy and reaction time performances for all the behavioral measures between the skilled and the impaired group. Additionally, spelling errors were assessed on the basis of whether a) the misspelling preserved the phonology (orthographic error e.g. explane for explain) or did not preserve the phonology (phonic error e.g purcuse for purchase) and b) if the errors involved addition /deletion /substitution/ transposition of consonants or vowels. Results. Independent sample t-tests revealed significant between-group differences on all the behavioural tasks except for orthographic awareness, such that the impaired group had lower accuracy rates and took longer to complete the tasks when compared to the skilled group. Spelling error analyses indicate that individuals with dyslexia commit more orthographic and phonetic spelling errors compared to skilled individuals, and that these errors involve substitution and deletion of consonants and vowels. Implications. This study found that individuals with dyslexia had lower levels of phonemic and morphological awareness as compared to skilled readers. In addition, their spelling production suggests deficits in understanding both the sound-letter correspondence rules (phonetic errors) and spelling-specific rules (orthographic errors). Spelling remediation for adults with dyslexia should include a focus on sound-letter correspondence rules and language-specific spelling rules.

References
Over the past century, global human life expectancy has more than doubled, increasing the importance of research on the effects of aging on cognition, including language processing. One of the clearest findings in this area of research appears to be an age-related decline in lexical abilities, as evidenced by increases in latencies and error rates in a number of lexical tasks, including lexical decision and picture naming (Au et al., 1995; Burke & Shafto, 2008; Connor, Spiro, Obler, & Albert, 2004; Gollan, Montoya, Cera, & Sandoval, 2008; Mortensen, Meyer, & Humphreys, 2006). However, it appears that this decline in lexical abilities is not uniform. Of interest here, some evidence suggests that object naming might decline in healthy aging to a greater degree than action naming (Barresi, Nicholas, Connor, Obler, & Albert, 2000). Although the reasons for this apparent dissociation remain unclear (and the noun-verb distinction confounds interpretation), one possibility is that lexical processing of words that are linked to motor skill knowledge may remain relatively spared. Such links could provide further conceptual/semantic support that may facilitate lexical processing, in the spirit of embodied cognition. Indeed, evidence from other populations, including Alzheimer’s disease, suggests dissociations between words that are or are not associated with motor skills (Chan, Salmon, & De La Pena, 2001; Silveri et al., 2012; Walenski, Mostofsky, & Ullman, 2007). Building on the results from Barresi et al. (2000), here we test the hypothesis that healthy older adults remain relatively spared at processing words associated with motor skills as compared to words that are not. We test this hypothesis both within verbs and within nouns, in both receptive and expressive lexical processing tasks, in three languages, controlling for both subject- and item-level factors. Experiments 1 and 2 assessed (unprimed) lexical decision for German nouns (Experiment 1, e.g., Kelle ‘ladle’ vs. Amsel ‘blackbird’) and Dutch verbs (Experiment 2, e.g., ik roei ‘I row’ vs. ik duld ‘I endure’) in younger and older German (N = 44) and Dutch (N = 60) native speaking adults, respectively. Both experiments yielded a significant interaction between age group and word type: While reaction times (RTs) were overall longer for older than for younger speakers, this increase was greater for words not associated with motor skills. Experiment 3 compared accuracy rates at the object naming of items that are commonly manipulated versus objects that are not commonly manipulated (e.g., hammer vs. panda) in English in 49 native English speakers ranging between 19 and 72 years.
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of age. This experiment also found a significant interaction between age and word type: While accuracy rates for non-manipulated objects declined with increasing age, this was not the case for objects such as ‘hammer’. In all studies, we controlled for subject- and item-level factors such as sex, form and lemma frequency, and word length. Taken together, the three studies provide converging evidence that aging impacts some types of lexical items more than others. Specifically, across receptive and expressive tasks, and across verbs and nouns, the lexical processing of words related to motor skills declines significantly less than the processing of words that are not linked to motor skills. We discuss potential mechanisms that may underlie this pattern. The findings may have therapeutic implications, not only for healthy aging, but also for age-related disorders.

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Processing Trade-off? Predicting from Foreign-accented Speech
Vincent Porretta, Lori Buchanan & Juhani Järvi-kivi

When understanding spoken language, the variability inherent to non-native speech can present a challenge for listeners. Research on the processing of foreign-accented speech has shown that the presence of a foreign accent reduces lexical activation and certainty of the intended message (Porretta, Tucker, & Järvi-kivi, 2016). However, previous research on native accent processing has established that listeners use linguistic information and real-world event knowledge to anticipate upcoming words (Altman & Kamide, 1999). In this study, we investigate the effect of foreign-accented speech on anticipatory processing of objects in simple transitive clauses, as well as the effect of listener experience with the accent. Using a Visual World Paradigm, experiment we examine the time-course of anticipatory eye movements to objects based on semantic information associated with the verb.

Following Altman and Kamide (1999), this study consisted of simple transitive sentence pairs in which the verb either restricted the subsequent direct object or not; for example, The fireman will climb the ladder, where climb restricts to ladder versus The fireman will use the ladder, where use could select a number of different objects. Two speakers—one native English and one native Mandarin—produced the English stimuli. Gaze data were recorded while native English-speaking participants listened to the sentences and looked at an array of four objects on-screen which included the target object (e.g., ladder). All participants also responded to a questionnaire assessing their experience interacting with Chinese-accented speakers. To examine the effect of accent and experience on anticipatory processing due to verb type, we modeled looks to the target object as a time series prior to the onset of the object word using generalized additive mixed-effects modeling (Wood, 2016).

While data collection is ongoing, preliminary analysis of data from 14 participants indicated greater and earlier anticipatory looks approximately 200 ms before the target object was heard for the native talker, with possible differences as early as during the verb. We will present the complete data set and analysis, discussing the effects of verb type and accent on the time-course of anticipatory looks to the target object, as well as the possible effect of listener experience. These preliminary results mirror the effect of verb type reported by Altman and Kamide (1999) and suggest that the processing costs associated with foreign-accented speech also impacts listeners’ ability to employ predictive processing both in magnitude and in timing. Further, the results speak to possible trade-offs in the allocation of processing resources; when faced with increased uncertainty and more effortful recognition of foreign-accented speech, bottom-up processing of the unfolding signal may take priority, leading to reduced prediction.
Factors influencing a person’s Cognitive Reserve (CR) include education and life-experience, and may predict language proficiency in vocabulary size, verbal analogy skills, and semantic processing (for a review, see Anstey & Christensen, 2000). Symptoms of cognitive decline can be difficult to detect when CR is high. However, some cognitive tasks might help to overcome this problem. One of the first symptoms of dementia is proper name anomia (Semenza, Mondini, Borgo, Pasini, & Sgarramella, 2003). Our hypothesis is that CR plays only a mild protective role in proper name retrieval (as compared to other types of nouns), due to the poor semantic connection between proper names and their bearers.

We investigated proper name, logo name and common noun retrieval, using CR as the main factor of interest. Forty-six Italian native speakers, from 65-96 years old (mean 81.09 ± 7.73), with 3-21 years of education (mean 8.89 ± 4.61) were enrolled. The participants’ cognitive profiles were assessed with the Montreal Cognitive Assessment (MoCA) and their raw scores ranged from 14-27 out of 30 (mean 20.63 ± 4.01). MoCA scores were adjusted for age and education prior to analysis (see Conti, Bonazzi, Laiacona, Masina, & Coralli, 2015). CR was measured with the Cognitive Reserve Index (CRI) questionnaire (Nucci, Mapelli, & Mondini, 2012). Participants were administered a picture naming task. Latencies and accuracies were recorded and Generalized Linear Mixed-Effect Models analyses were performed. CRI globally predicted both latency ($\chi^2 (1) = 10.3$, $p < 0.01$) and accuracy name retrieval ($\chi^2 (1) = 8.75$, $p < 0.01$), with better performance when CR was high. Latency was predicted by CRI and MoCA entered as interaction terms ($t = 7$, $p < 0.001$); Fig 1. Accuracy was predicted by CRI and MoCA entered as additional terms ($z = 3.19$, $p < 0.01$), showing stronger effects of CR when global cognitive profiles were in the low range. Considering proper names, logo names and common nouns, no significant interaction between CRI and name category was found on latency ($t = 0.76$, $p < 0.44$). Accuracy, by contrast, was predicted by CRI and category as interaction terms, with a weaker effect of CRI for proper names as compared to common nouns ($z = 2.69$, $p < 0.01$) and logo names ($z = 3.24$, $p < 0.01$), while the relationship between CRI and naming accuracy did not differ when comparing logo names and common nouns ($z = 0.81$, $p = 0.4$).

Higher CR improved name retrieval for accuracy and latency, with a stronger effect in persons with low-range cognitive profiles. Accuracy was more influenced by CR in the case of common nouns and logo names as compared to proper names. Logo names are also arbitrarily assigned to entities but can be categorized conceptually due to their environmental pervasiveness, whereas proper names are pure referential expressions for unique entities. This could partially explain the weaker relationship between proper names and CR, making proper name retrieval tasks useful for detecting early signs of cognitive decline when CR is high.

Language processing is strongly influenced by an individual’s linguistic knowledge (Keuleers, Stevens, Mandera, & Brysbaert, 2015; Kuperman & Van Dyke, 2013) and this knowledge and experience tend to accumulate over time (Verhaeghen, 2003; Keuleers et al., 2015). Conversely, processing speed tends to decrease across the life span (Hartshorne & Germine, 2015). To account for this discrepancy, Ramsar, Hendrix, Shaoul, Milin, and Baayen (2014) proposed that age-related changes in language processing mirror memory search costs associated with the growth of the mental lexicon. Intriguingly, a growth-based trajectory of the lexicon runs counter to the well-known more-is-better effect in reading (within an age group): increased lexico-semantic connectivity facilitates reading speed (Yap, Tan, Pexman, & Hargreaves, 2011) and more experienced and proficient readers tend to be both more accurate and faster. Moreover, age is only one factor that can influence accumulation of linguistic knowledge. Education is another, but its relation to language processing across the life span is not well understood (Zahodne et al., 2011; Murphy, Rabelo, Silagi, Mansur, & Schochat, 2016). In this study, we investigate the contribution of experience as indexed by both advancing age and levels of education, and their interactions with structural and semantic aspects of morphological complexity in language processing.

Using a dataset by Keuleers et al. (2015), we focused on suffixed bimorphemic English words. Lexical decision accuracies and reaction times of 2,128 such words were averaged over participants within experience groups comprised of five age groups, from 24 to 60+ years, and four levels of education. In total, the data set contained of 42,560 observations. As a measure of morphological structure, we used relative frequency, i.e., the

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log ratio of the base (boy) and the full form (boyhood) frequencies (see Hay, 2001). The data were modeled using a generalized additive mixed effects model. The variables of interest were the simple main effect of experience in addition to its interaction with relative frequency. Furthermore, the following control variables were included: length in letters, orthographic similarity and semantic transparency.

The simple main effect of experience showed that within each age group higher levels of education were associated with faster processing and increased accuracy. Words that had a relative frequency more biased towards the full form were processed faster and more accurately. Attenuation of this frequency effect emerged gradually in higher levels of education for base-biased words. In contrast, advancing age showed the typical effect where accuracy increased but speed decreased. With increasing experience over time, however, the differences between language processing trajectories appeared to level off along the relative frequency range. With regard to full form-biased words, the difference in speed between the oldest with a PhD and the youngest with a high school education was not statistically significant. For accuracy, the trajectories between the oldest with a high school education and the youngest with a PhD were not statistically different.

In sum, the results indicate that accumulation of knowledge may lead to different performance trajectories depending on how experience accumulates—slowly over age or in more concentrated and specialized spurts that education provides. Additionally, this language experience appears to shape morphological structuring; words become increasingly processed as units with advancing age and this process seems to be amplified with higher levels of education. Thus, the results appear to strongly manifest the “use it or lose it” principle.

References
Friday, September 28

Platform Session 3.1
Chair: Lori Buchanan

08:40–09:00
When Switching Language is Cost-free
Michela Mosca, Chaya Manawamma & Kees de Bot

09:00–09:20
On-line Evidence for Processing Difficulties with Nominal Compounds in Native Speakers of English
Leigh Fernandez, John Gamboa & Shanley Allen

09:20–09:40
A Word or Two about Nonwords
Peter Hendrix

09:40–10:00
Form Priming by Discontinuous Consonant Letter Strings in Visual Masked Priming
Skye Anderson & Jonathan Geary

08:00 - 08:40 Coffee / Registration

08:40 - 10:00 Platform Session 3.1

10:00 - 11:40 Poster Session P.4 & Refreshments

11:40 - 13:20 Lunch Break

13:20 - 14:20 Keynote Lecture: Learning and Processing Words Face-to-face: The Role of Multi-modality and Iconicity
Gabriella Vigliocco

14:20 - 15:20 Platform Session 3.2

15:20 - 15:40 Coffee Break

15:40 - 17:00 Platform Session 3.3

17:00 - 17:30 Student Awards and Closing Remarks
The goal of this study is to determine to what extent language switching in bilingual speakers is a costly process. It is widely agreed that when bilinguals use one language, the other one is inhibited. In order to switch language, this inhibition needs to be overcome (Green, 1998) and the new language has to be reconfigured (reconfiguration model, e.g., Rogers & Monsell, 1995).

Both processes take some time to be fulfilled, leading to the so-called “language switching costs”.

While inhibition decay is a passive process during which inhibition gradually dissipates (Allport, Styles & Hsieh, 1994), reconfiguration is an active process that dynamically prepares the system for the new task (e.g., Meiran, 1996; Rogers & Monsell, 1995). Hence, reconfiguration can be considered the “mental gear” that allows language switch: It includes processes such as shifting the attention to the new language, retrieving the rules of that language (such as grammatical and phonological rules) and inhibiting the non-intended language.

A way to examine language reconfiguration is by informing the speaker about the language to use beforehand. Previous studies have shown that when speakers are given time to prepare for the upcoming language, switching costs are reduced (e.g., Guo, Ma & Liu, 2013; Ma, Li & Guo, 2016). However, longer preparation can foster not only the active preparation of the new language but also the passive dissipation of the inhibition from the previous task. This can happen when the interval between trials is relatively short (e.g., Declerck, Koch & Philipp, 2013; Costa & Santesteban, 2004) or is left uncontrolled (e.g., Verhoe, Roelofs & Chwilla, 2009; Fink & Goldrick, 2015). In fact, in order to investigate the reconfiguration process only, the interval between trials needs to be relatively long so to allow complete dissipation of the inhibition coming from the previous utterance. Specifically, it has been shown that when the interval between trials is relatively long, a preparation time of 800ms allows bilinguals to switch cost-free (Mosca & Clahsen, 2016). However, while this result indicates that is possible to eliminate switching costs, it leaves unclear how much preparation time is necessary to fully prepare for a language switch and so to switch cost-free.

To address this issue, we tested 30 native speakers of Dutch (mean age: 22 years; 6 males) with a good proficiency of English (81.5% of the LexTale, Lemhöfer & Broersma, 2012; L2 mean AoA: 10.4 years) in a picture naming task involving language switching. The interval between trials was held relatively long (> 3000ms), whilst preparation time was manipulated by displaying the language cue before the stimuli (Cue to Stimulus Interval, CSI= 800ms, 500ms, and 250ms) and together with the stimuli (CSI= 0ms). Results revealed that language switching was costly when speakers were given no time to prepare but not when some preparation time was provided. Precisely, language switching became cost-free when preparation time was relatively long (800ms and 500ms) but also when preparation time was as short as 250ms. This finding suggests that language switching can be a cost-free process and that bilinguals require less than 250ms to fully prepare for a language switch.

On-line Evidence for Processing Difficulties with Nominal Compounds in Native Speakers of English

Leigh Fernandez, John Gamboa & Shanley Allen

One frequently used construction in academic writing is the nominal compound (NC). NCs are particularly well-suited to academic texts because they convey complex information in a condensed form (e.g. treatment facility). They obligatorily contain a head noun such as facility, and are modified by one or more elements that extend and focus the meaning of the head noun (e.g. waste treatment facility). These types of NCs are efficient in communicating complex information but can be difficult to understand given that they contain high information density, there is no one standard syntactic or semantic relationship between the words in an NC, and the reader must hold the modifiers in working memory until reaching the head noun at the end of the NC. However, these difficulties have primarily been shown with offline methods (e.g., Carrió Pastor, 2008; Gleitman & Gleitman, 1970; Limaye & Pompian, 1991). Research using online methods has only investigated NCs comprised of two words (e.g., Estes & Jones, 2006; Gagné & Shoben, 1997; Gagné, Spalding, & Park, 2015).

In the present study we use eye tracking to investigate the online processing of NCs, and compare this to processing of the counterpart prepositional phrases (NPP) in which the relationship between the elements is clearer (Phrase Type: NC vs. NPP; see Table 1). We also compare two lengths of NCs/NPPs typical of items found in academic texts (Length: 3 vs. 4 elements). We hypothesize that that the NC will evoke longer reading times compared to the NPP, and that longer phrases will evoke longer reading times compared to the shorter phrases.

Table 1. Example stimuli

<table>
<thead>
<tr>
<th>ROI 1</th>
<th>ROI 2</th>
<th>ROI 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC-3</td>
<td>the inflation constraint action is implemented by the board of the national bank</td>
<td></td>
</tr>
<tr>
<td>NPP-3</td>
<td>the action for the constraint of inflation</td>
<td></td>
</tr>
<tr>
<td>NC-4</td>
<td>the currency inflation constraint action</td>
<td></td>
</tr>
<tr>
<td>NPP-4</td>
<td>the action for the constraint of inflation of the currency</td>
<td></td>
</tr>
</tbody>
</table>

Native English-speaking participants (n=19) read the sentences while having their eyes tracked. We compared first fixation
The 11th International Conference on the Mental Lexicon

overwhelming frequency effect not only for words, but also for lexical decision latencies. The PAM analyses revealed an effect of phrase type with the NC having longer FFD (p<.02) and GD (p<.001) than then the NPP.

This suggests that the difficulty arising from the NC lingers into the second ROI and causes longer FFD and GD, but that this difficulty is dealt with in these early measures. In an ongoing study we are also investigating L2 speakers of English with L1 German vs. L1 Spanish to test for cross-linguistic influence, given that German allows NCs while Spanish does not. Overall this study clearly shows that NCs cause reading difficulties, and we should be aware when writing academic texts that these frequently used constructions can tax the reader.

References

A Word or Two about Nonwords
Peter Hendrix

The perhaps most basic experimental task in psycholinguistic research is lexical decision. Participants are presented with a sequence of letters and are asked to decide if this sequence of letters is a real word or a nonword. Typically, the interest of researchers is in the response patterns for real words, and the responses to nonwords receive little attention. Here, we take a closer look at the lexical decision latencies for nonwords in a large-scale lexical decision database, the British Lexicon Project (henceforth BLP; Keuleers et al., 2012).

We analyzed the lexical decision latencies for 18,568 words and 10,000 nonwords in the BLP using piece-wise exponential generalized additive models (henceforth PAMs; cf. Bender, Groll and Scheipl, 2018). In the context of lexical decision data, PAMs offer the possibility to predict the time until a participant makes a decision about the lexical status of a letter sequence through instantaneous hazard rates. Instantaneous hazard rates describe the probability that a participant makes this decision at time t, provided that no decision was taken prior to time t. Through the use of PAMs, non-linearities can be modelled in both the predictor dimension and the time dimension. PAMs thus provide rich information about the temporal development of predictor effects.

In addition to a number of well-known predictor effects (i.e., the effects of word length and letter bigram frequency), we observed an interesting and novel frequency effect for nonwords. Traditionally, it is believed that a frequency effect for nonwords is, by definition, impossible, because nonwords do not have a frequency. Google searches in the English language for the nonwords in the BLP, however, revealed that the median Google frequency of the nonwords under investigation in the Google search index is no less than 25,600.

The Google frequency of nonwords proved highly predictive for lexical decision latencies. The PAM analyses revealed an overwhelming frequency effect not only for words, but also for nonwords. This effect was most prominent for the lower part of the response time distribution. Whereas the probability of an instantaneous response was higher for high frequency real words, it was lower for high frequency nonwords. Participants therefore found it harder to “reject” nonwords with a higher Google frequency.

Furthermore, we observed effects of both orthographic and semantic neighborhood density. We defined orthographic neighborhood density as the average Levenshtein distance between a nonword and its closest real word orthographic neighbors. Semantic representation for nonwords are not available through traditional methods. Recent advances in distributional semantics (Bojanowski et al., 2016), however, have made it possible to generate semantic vectors for words that are not in the input data and, by extension, for nonwords. On the basis of the semantic vectors for nonwords, we defined semantic neighborhood density as the average cosine similarity between a nonword and its closest real word semantic neighbors.

For words, we found facilitatory effects of both orthographic and semantic neighborhood density that were relatively stable over time. The greater the number of orthographic or semantic neighbors, the greater the hazard rates. For nonwords, we observed the opposite pattern of results. Hazard rates were lower for nonwords that live in denser orthographic and semantic neighborhoods. Both orthographic and semantic properties of real words thus have a significant impact on lexical processing for nonwords. To our knowledge, this study is the first to report a semantic neighborhood density effect for nonwords.

The results reported here suggest that the difference between words and nonwords is gradient rather than absolute in nature. First, we observed robust effects with a similar temporal development for both word and nonwords for a number of well-established lexical predictors. Second, the PAM analysis revealed that it is harder to reject nonwords that are more word-like in terms of frequency, orthography, and semantics. The current results suggest that words and nonwords live in the same dis-
tributional space and that nonword reading is, to a large extent, guided by the same principles as word reading.


Keuleers, E., Lacey, P., Rastle, K., & Brysbaert, M. (2012). The British Lexicon Project: Lexical decision data for 28,730 mono-
syllabic and disyllabic English words. Behavior Research Methods, 44(1), 287–304.


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Form Priming by Discontinuous Consonant Letter Strings in Visual Masked Priming

Skye Anderson & Jonathan Geary

Introduction

We report a visual masked priming study that tests whether English verbs are primed by their consonant graphemes in isolation (e.g. whether grw primes GROW) and whether this differs for regular verbs vs. irregular verbs (e.g. walk/ed vs. grow/grew). We hypothesized that constituent consonant strings would elicit priming based on similar findings in Semitic (though such strings may constitute morphemes in such languages) (e.g. Frost et al. 1997, Velan and Frost 2009), and on previous work showing a consonant advantage in spoken word recognition. For example, listeners can learn word boundaries defined by transitional probabilities between consonants only but not vowels only (Bonatti et al. 2005) and when asked to reconstruct a real word from a non-word by changing one segment, speakers prefer to preserve consonants (turning kebra into cobra rather than zebra) (Cutler et al. 2000). This indicates that consonantal structure is more tightly coupled with word identity than vowel structure. We ask if this extends to the visual modality and if vocalic inconsistency across inflected forms of irregular verbs plays a role.

Methods

48 native monolingual English speakers (Mage = 21.5 yrs, 12 men) participated. Participants judged the lexicality of 60 English verbs (30 regular, 30 irregular) and 60 non-words. Targets were 3-6 letters long with 2-4 consonant graphemes. Real-word targets occurred in 3 priming conditions: repetition (grow primed GROW), related (grw primed GROW), and unrelated (ctd primed GROW).

Results

Response times (RTs) were analyzed by fitting a Linear Mixed Effects model in R (R Core Team 2015) using the lme4 package (Bates et al. 2015) and using the lmerTest package to simulate Satterthwaite approximations for degrees of freedom (Kuznetsova et al. 2016). Fixed effects included priming condition (repetition, related, control; ref. level: control), verb type (irregular, regular; ref. level: regular), frequency (SUBTLEX-US log contextual diversity; Brysbaert and New 2009), number of lexical neighbors, and the interaction of priming condition by verb type. The effects of priming in the repetition and related conditions were significant (t(3503) = -7.4, p < 0.001 and t(3504) = -4.0, p < 0.001, respectively); participants responded faster to real words in the repetition and related conditions than in the control condition. Verb type and the priming condition by verb type interactions were not significant (p > 0.05).

Discussion

English verbs are primed by their constituent consonant let-
ters, indicating that the auditory consonant advantage in word recognition extends to the visual modality, though no evidence was found that it is stronger for irregular verbs. This result has implications for models of phonological encoding in visual word recognition, such as whether phonological encoding of orthographic words occurs sequentially or in parallel and at the segment or syllable level. Most work on this issue has tested prime-target pairs exhibiting total phonological overlap, making it difficult to diagnose either the unit (phoneme or syllable) or the method (parallel or sequential) of encoding. Carreiras et al. (2005) tested partially overlapping prime-target pairs and found priming when overlap was in the first phonologi-
cal syllable. The present study shows that even non-syllabic, non-contiguous overlap between prime and target allows for priming, possibly indicating that phonological encoding occurs in parallel and at the segment level.
1. The Semantic Representation of Abstract Verbs
Emiko Muraki, Alison Heard, David Sidhu & Penny Pexman

2. Whole Word Frequency Effects in L1 and L2 Masked Priming (Very Little Corn in Corner or Cornet)
Juhani Jarvikivi & Kaidi Lõo

3. The Barking Tree: Eye-tracking Evidence for Early Access to Semantically Ambiguous Lexical Roots in Sentences
Roberto G. de Almeida & Gary Libben

Shiloh Drake

5. NO Acoustic Correlates of Grammatical Class — Failure to Replicate Sereno & Jongman (1995)
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6. Learning Beyond Words: Learning and Generalization of a Complex Morphological Construction in Children and Adults
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8. Short-term and Long-term Effects of L1 on Language-specific and Cognitive Control Tasks in Highly Proficient L2 Speakers
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9. Can you Reach for the Planets or Grasp at the Stars? — Modified Noun, Verb, or Preposition Constituents in Idiom Processing
Eva Smolka & Carsten Eulitz

10. Interpretational Diversity in Novel Compounds and What the Head Noun Has to Do with It
Melanie Bell & Martin Schäfer

11. Intervention in Two Rhyme Priming Tasks
Hezekiah Akiva Bacovcin, Amy Goodwin Davies & Robert Wilder

12. I Know Spanish. What Romance Language Should I Learn Next?
David Beard, Emily Neff & Ally Bucher

13. Constructing Two Vietnamese Corpora and Building a Lexical Database
Hien Pham, Benjamin V. Tucker & Harald R. Baayen

14. The Semantics of Relationships: Hebrew Prepositions in Early Acquisition
Elisheva Salmon, Elitzur Datner & Dorit Ravid

15. Lexical Availability of Bilingual Students in a High School Institution Specialized in Agriculture
Willelmira Castillejos Lopez

16. Concrete and Abstract Word Learning in Developmental Language Disorder: A Computational Exploration
Armand Rotaru, Alessandro Lenci & Gabriella Vigliocco

17. What Can Typing and Writing Tell Us about Morphological Planning?

18. Processing Asymmetries Between Prefixed and Suffixed Forms in Bengali
Benan Zhou, Hilary Wynne, Sandra Kotzor, Swetlana Schuster & Aditi Lahiri

19. Morphologically Mediated Syntactic Priming in Visual Lexical Decision: Evidence from Russian Anastasia Chuprina, Nicholas Lester & Natalia Slioussar
The average adult knows the meanings of thousands of abstract words (e.g., realize). Explaining how this knowledge is acquired and stored has been a challenge for grounded cognition theories, wherein semantic knowledge is grounded in sensorimotor representations (Barsalou, 2008). Multiple representation theories, drawing from both grounded cognition and amodal representation theories, propose that abstract words may rely on simulation of a variety of systems to access word meaning, such as systems dedicated to processing emotional, introspective and linguistic experience (Barsalou, 2008; Borghi & Binkofski, 2014). Thus far, abstract words have been treated as a homogenous group, limiting our ability to investigate the influence of different underlying representational systems amongst these words. In the present study we examined lexical-semantic processing of abstract verbs, separating them into cognitive, emotional and non-bodied word types. We used a go/no-go syntactic classification task in two separate experiments to investigate behavioural and neurological differences between these word types. In the behavioural experiment we analyzed the differences in reaction times and in the neuroimaging study we recorded associated event-related potentials (ERP) during the task to analyze the amplitude of the N400 ERP component. Both reaction time and the N400 amplitude are measures sensitive to differences between concrete versus abstract words. Amongst our 61 behavioural participants, cognitive abstract verbs showed significantly faster response times than non-bodied abstract verbs. This significant difference did not emerge in the N400 amplitude in the analysis of the 20 participants who have so far completed the neuroimaging study, however, data collection is ongoing with a target sample of 40. The current results suggest that cognitive abstract verbs may have a previously unreported processing advantage and, more importantly, provide support for the proposal that different modal and linguistic systems contribute to abstract concept representation.

Whole Word Frequency Effects in L1 and L2 Masked Priming (Very Little Corn in Corner or Cornet)
Juhani Järvikivi & Kaidi Lõo

The strong view of obligatory morphological decomposition has found support from masked priming studies showing comparable facilitation for words with real decomposable and only apparent structure, like harpist and corner, but not for words with just embedded stems, like harpoon or cornet (Rastle et al., 2004), suggesting automatic parsing based on form alone. Some research suggests that this is the case with L2 speakers as well (Diependaele et al., 2011), while some suggests that L2 speakers also parse words with embedded stems (Heyer & Clahsen, 2015). On the other hand, evidence is accumulating not only showing no difference between corner and cornet words, but also finding no significant facilitation for them (e.g., Milin et al., 2017), or larger facilitation for real decomposable words (Feldman et al. 2009). As most masked priming studies have not only been done between-item but have also compared words like corner to derived affixed words, the effects of equal magnitude for the two have been interpreted as involving similar processing. We asked the extent to which this is the case by comparing the effects of prime and target distributional properties, here frequencies, across the prime types within-item.

77 native speakers of English and 62 non-native speakers of different L2 backgrounds participated in the experiment. In addition to the forward masked primed lexical decision task (500 ms prime; TARGET), the non-native speakers were administered a self-assessment proficiency questionnaire as well as LexTale placement test in English. 40 monomorphic words were selected as targets; 4 prime types were used (Prime: corns, corner, cornet, eyes (unrelated) – target: CORN). Note that we used both derived and inflected forms of the stem in the transparent morphological condition. Frequencies and morphological family sizes for the primes and targets were determined using COCA. The results were analysed using Generalized Additive Mixed Models.

Native speakers showed significant facilitation for the transparent words only, whereas the other two conditions did not differ from the unrelated. Adding frequency showed a significant interaction that was different for transparent (words with low prime and target frequency were slowest) and the other two conditions (higher prime than target frequency slowed down responses). The L2 speakers showed the same results (facilitation for real morphology only), with the addition of an interaction between self-reported proficiency and condition: Higher proficiency predicting slower processing of decomposable words (p = 0.0028). The family size ratio between prime and target was not significant, possibly because of the relatively small family sizes in English compared to morphologically more complex languages (cf. Järvikivi & Pyykkönen, 2011).

First, our results showed that native and non-native speakers behaved identically, showing facilitation for true morphological relations only. Not only were the results for ‘corner’ and ‘cornet’ words the same, but also neither produced significant priming. Second, the prime-target frequency ratio inhibited processing when the primes were higher frequency than the targets, but only for ‘corner’ and ‘cornet’ words, and to the same degree. Third, L2 proficiency affected processing, but for transparent primes only. These results agree with recent literature showing diminished or no effects for ‘corner’ and ‘cornet’ words, compared to true morphologically decomposable words. Further, they show that frequency differently affects processing of real and pseudo morphology in masked priming.
In this study, we investigate the role that sublexical units such as roots play in the early moments of language comprehension. Our study builds upon the work of Libben and de Almeida (2002) that focused on suffixed English words such as barking, which contain semantically ambiguous roots. The suffixed word barking contains the root bark, which could be either a verb (i.e., the sound that a dog makes) or a noun (i.e., the surface of a tree). Accordingly, the word bark will prime the word tree, and the word bark will also prime the word dog. However, if morphology can constrain how a root is activated, the addition of the suffix -ing to a word such as bark should eliminate the ambiguity because -ing suffixation ‘selects’ only the verb reading of bark. This prediction was tested in a masked-priming lexical decision task, in which the expected priming effects for consistent whole-word meanings (e.g., barking-DOG) were found but, surprisingly, a robust negative priming effects for inconsistent prime-target pairs (e.g., barking-TREE) was also found. These results suggest that both meanings of the ambiguous root are accessed during recognition. The results are consistent with the view that all lexical representations that can be activated, will be activated.

The Libben and de Almeida (2002) study was restricted to single word processing in a primed lexical decision task. It remains unclear whether its effects can also be obtained during sentence processing, which better represents how morphological computations are carried out in natural language use. The present study was designed to address this question through an eye-tracking study of words such as ‘barking’ in sentence contexts. We inserted prime-target pairs into four types of sentences, three of which contained syntactic/semantic anomalies. The anomalous conditions were created to test the relation between a prime word (the morphologically complex one: barking) and a target (dog). One prime-target pair was presented with no anomaly (e.g., *He heard loud barking during the night on Saturday). Prime-target pairs for the other sentence types were constructed to be completely unrelated (e.g., *He heard loud barking during the fail on Saturday, a control), related to the whole word and root of the prime (e.g., *He heard loud barking during the dog on Saturday), or related only to the root of the prime (e.g., *He heard loud barking during the tree on Saturday). Participants (N=114) read sentences while wearing and a head-mounted eye-tracker. We found results consistent with Libben & de Almeida’s (2002). As expected, all anomalous conditions (dog/bark/fail) yielded significantly longer gaze durations than the grammatical condition (night). More importantly for our purposes were the differences between anomalous conditions: longer gaze durations for the unrelated condition (barking-fail) than for the target consistent with the whole-word prime (barking-dog). Facilitatory effects for the unbiased meaning of the root (tree) did not reach significance, although numerically faster than the unrelated condition. The lack of difference between the two targets related to the root (dog, tree) suggests that the two meanings of the ambiguous root were accessed in the processing of the sentences.

Reference


What Can a Wug Test Tell Us about Abstract Morpheme Storage? A Behavioral Account

Shiloh Drake

Novel word elicitation tasks, or Wug Tests, can be used to probe morphological development (Berko, 1958), morphological productivity (Drake, in press; Twist, 2006), as well as ability to learn artificial grammars (Ettlinger, Morgan-Short, Faretta-Stutenberg, & Wong, 2016; Wong, Ettlinger, & Zheng, 2013). In the present research, I use the qualitative results from such a task to propose that native Maltese and Arabic speakers use their knowledge of abstract CV structures in their L1 to aid their learning of an artificial language. Previous research suggests that in addition to roots and patterns, speakers of Arabic and Maltese also store a phonological consonant-vowel template in their lexicons (Boudella & Marslen-Wilson, 2004; Galea, 2011; McCarthy, 1979, 1981). This CV skeleton of a base form allows speakers to appropriately apply concatenative or non-concatenative morphemes as appropriate in Maltese (Galea, 2011) as well as providing syntactic and semantic information about the word in Arabic (Boudella & Marslen-Wilson, 2004; McCarthy, 1981).

In my research, I use a Wug Test with an artificial grammar employing non-concatenative morphology based on broken plurals in Arabic and Maltese: kitaab/kutub, ktieb/kotba ‘book/s’. Participants speaking Arabic or Maltese used some non-concatenative morphology in their responses, while English-speaking participants tended to employ their English-like concatenative morphology in spite of the grammar not using concatenative morphology at all. A sample of expected ‘grammatical’ responses and actual responses from each type of speaker is provided in the table below.

Singular Expected Arabic English Maltese
funatu fruta fantu funati fnati
kidufu kadfu kiduda kudifi kidifi
kishuma kushmim kashmas kishmu kxejjem

Thus, although no speaker group fully learned the grammar and the difference between the groups’ performance on the
The present paper describes an extended replication of a widely cited reading study that reports an effect of grammatical category on homophone pronunciation (Sereno & Jongman, 1995). More specifically, Sereno & Jongman (1995) observe acoustic differences between noun and verb pronunciations of English disyllabic, non-stress-shifting homophone pairs, for example, answer (v) vs. answer (n) or design (v) vs. design (n). The main result reported is that the noun tokens exhibit a tendency toward trochaic and the verb tokens toward iambic pronunciation, reflecting the general difference in position of stress between nouns and verbs (e.g., Davis & Kelly, 1997). This means, for example, that speakers still pronounced design with iambic root, this provides further evidence for a strong link between morphological representation as abstract as a CV skeleton in a speaker’s lexicon.

The finding has given rise to significant conclusions: It has been discussed as providing evidence for the existence of acoustic cues for the disambiguation of noun-verb homophones (e.g., Gaskell & Marslen-Wilson, 2001) and for the learning of grammatical categories in first language acquisition (e.g. Monaghan et al., 2007).

However, a closer look at the results obtained by Sereno & Jongman (1995) indicates that the empirical evidence for the effect of grammatical category is rather slim, as the acoustic differences between nouns and verbs do not consistently reach statistical significance. The original study was based on a very small sample size (n=160), as only five speakers were recorded. The non-significant results may therefore reflect a lack of statistical power in the original experiment.

The non-significant results may therefore reflect a lack of statistical power in the original experiment. Differences between nouns and verbs do not consistently reach statistical significance. The original study was based on a very small sample size (n=160), as only five speakers were recorded. The non-significant results may therefore reflect a lack of statistical power in the original experiment. Differences between nouns and verbs do not consistently reach statistical significance. The original study was based on a very small sample size (n=160), as only five speakers were recorded. The non-significant results may therefore reflect a lack of statistical power in the original experiment. Differences between nouns and verbs do not consistently reach statistical significance. The original study was based on a very small sample size (n=160), as only five speakers were recorded. The non-significant results may therefore reflect a lack of statistical power in the original experiment.

The current replication investigates whether the trends found in the original study can be corroborated when increasing power through eliciting a considerably larger number of target word productions (n=2,560). To that end the production study was replicated with 40 speakers, each of whom produced twice the number of target words. A power analysis employing Monte Carlo simulations based on the original data indicates that the replication study has more than sufficient power to find effects of the size observed in the original data. An acoustic analysis of the newly acquired recordings that tested shifts between the two syllables on the acoustic parameters of duration, fundamental frequency and intensity does not indicate any statistically significant effect of grammatical category on acoustic realization. Given that the study was considerably overpowered, the current replication suggests that the category effect either does not exist or is infinitesimal in size.

While Sereno & Jongman (1995) state their results to show a direct effect of grammatical category on the phonetic modulation of stress, the null-result is compatible with models of speech production that assume the phonetic realization of stress to be the sole effect of a metrical template that is the same for both the noun and verb homophone tested.
The current study investigates whether the unique morphological elements of Hebrew allow for learning not only different levels of conceptual abstraction, but also complex, multi-layered form-meaning associations, and whether age impacts this systemic learning.

Words in Semitic languages such as Hebrew are typically characterized as a combination of two interleaved morphemes – a (tri)consonantal root and a vowel pattern. To date, most psycholinguistic studies in children and adults have focused on how roots and patterns reflect the organization of Hebrew-speakers’ mental lexicon [e.g. 1, 2,3,4,5]. In contrast, the current study investigates the complex relationship between morphological and conceptual learning in adults and children. Consider for example the Hebrew word-family referring to types of illnesses. The word całévet ‘jaundice’ encodes a basic category, while the underlying morphological pattern CaCÉCet encodes the general category of illness. Other words of the same pattern (such as xazéret ‘measles’) are thus not only conceptually but also formally related to jaundice (unlike the parallel English terms). This reflects a unique organization of the mental lexicon which impacts processes such as word retrieval. However, the synthetic nature of Semitic words not only connects between the word form and its meaning at the local level, but also between the words themselves as constructions that represent an entire category.

How well can Hebrew speakers implicitly learn a novel pattern which encodes such complex systemic relationships from a relatively few exposures? To answer this question, we use an experimental design relying on the morphological structure of Hebrew. We created a formal environment that allows for systemic learning. Words in Semitic languages such as Hebrew are typically characterized as a combination of two interleaved morphemes – a (tri)consonantal root and a vowel pattern. To date, most psycholinguistic studies in children and adults have focused on how roots and patterns reflect the organization of Hebrew-speakers’ mental lexicon [e.g. 1, 2,3,4,5]. In contrast, the current study investigates the complex relationship between morphological and conceptual learning in adults and children. Consider for example the Hebrew word-family referring to types of illnesses. The word całévet ‘jaundice’ encodes a basic category, while the underlying morphological pattern CaCÉCet encodes the general category of illness. Other words of the same pattern (such as xazéret ‘measles’) are thus not only conceptually but also formally related to jaundice (unlike the parallel English terms). This reflects a unique organization of the mental lexicon which impacts processes such as word retrieval. However, the synthetic nature of Semitic words not only connects between the word form and its meaning at the local level, but also between the words themselves as constructions that represent an entire category.

How well can Hebrew speakers implicitly learn a novel pattern which encodes such complex systemic relationships from a relatively few exposures? To answer this question, we use an experimental design relying on the morphological structure of Hebrew. We created a formal environment that allows for simultaneous encoding multiple conceptual levels – a novel nominal paradigm (analogous to CaCÉCet) in which basic level concepts (moving entities) are encoded by the combination of a specific root and a vowel pattern while the more general category (manner of motion) is encoded by the morphological pattern underlying the word family. Thirty-six adults and twenty-four children, all native Hebrew-speakers, participated in two conditions of implicit learning – conceptual and morphological. Each word-learning condition included six different novel pseudo-words (names of moving characters that were presented in a short animated video). The conceptual condition included two groups of entities that reflect sub-types of the general concept of manner of motion (skipping vs. flipping). In the morphological condition these concepts were encoded in two groups of words via two vowel patterns. We explored the learning of the relationship between the word forms and their meanings in the two conditions.

Results revealed that both children and adults learned the two categorial levels encoded by the word forms in the two learning conditions (proper name and manner of motion). Moreover, the two morphological patterns were learned and generalized by the two groups. However, adults learned the different form-meaning associations better than children – both basic level concepts and general categories. We suggest that the internal structure of Semitic words creates an environment of regularities that provides individuals with unique affordances in word learning. Conceptual and morphological similarities are involved in the systemic organization of Hebrew words as a network, and this organization can impact the inclusion of new lexical units as members of the abstract category. The similarities and differences in the learning outcomes for the two populations will be discussed in terms of their implications on the development of the mental lexicon of Hebrew speakers.

References

Learning Beyond Words: Learning and Generalization of a Complex Morphological Construction in Children and Adults
Niveen Omar, Bracha Nir & Karen Banai

The 11th International Conference on the Mental Lexicon
Most research into morphological processing has been concerned with the recognition of single-affixed words such as governor or insincere (Marslen-Wilson et al., 1994), as well as the requirements that need to be met for decomposition to occur (e.g. semantic compositionality, frequency, type of affix). It is only recently that complex words that are the result of a number of derivations have become a focus of investigation (e.g. Meinzer et al., 2009; Pliatsikas et al., 2014).

In Pliatsikas et al. (2014), superficially matched complex words such as eyeing and running showed differential activity in the left inferior frontal gyrus during an fMRI experiment, depending on the derivational depth of the complex word: Two-step derived complex words such as eyeing (eyeN > eyeV > eyeing) elicited higher activation than their one-step derived counterparts such as running (runV > running). Similar findings are reported in Meinzer et al. (2014) for German complex nouns.

Building on these results, the present study is a multi-method investigation of derivational depth in morphologically legal, but unattested novel forms in German. Using a combination of behavioural, neurophysiological and neuroimaging data, we found that German native speakers showed sensitivity to the lexicality of ‘hidden’ intermediate derivational steps during the processing of two different sets of derived novel forms. Both sets were constructed using the same, productive sequence of derivations: base adjective > zero-derived verb > suffix-noun in -ung. The critical intermediate derivation was either attested *Spitzung (spitzA ‘sharp’ > spitzenv > *SpitzungN) or morphologically legal, but unattested in *Hübschung (hübscha ‘pretty’ > *hübschenV > *HübschungN). In an ERP experiment with cross-modal priming, items with an attested intermediate derivation such as *Spitzung led to significantly greater reduction in the N400 component than *Hübschung for which the intermediate derivational step does not exist, thereby priming their base spitz more strongly relative to an unrelated control. Through a separate lexical decision task with delayed priming in which semantic and form controls were included, it could be established that the effect was not reducible to form or meaning.

Although both base adjectives spitz and hübsch exist, and the novel forms are unattested in both conditions, we found that the lexicality of the intermediate derivational step facilitated recognition of the base form in *Spitzung more than in *Hübschung. Overall, our findings demonstrate that hidden derivations that are not visible on the basis of the surface make-up of a complex form may have important consequences for processing.

Recent models on bilingualism offer different explanations for performance differences between monolinguals and bilinguals: the long-term effects of reduced language experience (e.g., Gollan et al., 2008) versus the short-term effects of dual language-activation that leads to cross-language influences (Kroll et al., 2014).

The present study compared the influence of both long-term effects (i.e. language exposure to L1 versus L2) and short-term effects (i.e. L1 interference) on a language-specific and a cognitive control task in highly proficient L2 speakers and monolinguals. Forty university students, 20 native speakers of German and 20 highly proficient Russian-German bilinguals, participated in a picture naming task (Exp. i) and a flanker task (Exp. 2). In Experiment 1, participants saw 288 different sets of pictures and colors and produced noun phrases that included the indefinite article, the color adjective, and the name of the object, such as “eine blaue Blume” (‘a blue flower’). Half of the nouns had congruent, half had incongruent grammatical gender between Russian and German (the grammatical gender systems of the two languages show structural overlap). In Experiment 2, participants performed a flanker task. Half through each of the experiments, all participants were exposed to a 10-minute movie clip in Russian, which introduced the L1 interference for the bilingual participants. We measured RTs and errors in both experiments. We hypothesized that bilinguals will be affected by the L1 interference on the language-specific but not on the control task.

The accuracy data showed no main effect of group, indicating that the bilingual group was highly proficient. Rather, the self-rated German proficiency by both bilinguals and monolinguals affected agreement responses, with higher proficiency predicting fewer errors. However, the two groups differed in two aspects: First, while monolinguals were not affected by gender congruency, bilinguals produced more errors on gender-incongruent than on gender-congruent nouns. Second, monolinguals made fewer naming errors after the movie than before the movie (a practice effect), while this effect disappeared in bilinguals after the exposure to the Russian movie, indicating L1 interference. The naming accuracy of bilinguals was further influenced by their switching behavior, and the naming latencies of bilinguals were affected by the frequency of the noun in their L1. The results of the flanker task showed that all participants displayed the expected congruency effect with faster and more correct responses to congruent than to incongruent trials. Most importantly, the performance of the two groups did not differ on the flanker task, and the exposure to the L1 movie had no effect on the bilingual group.

The findings of the flanker task confirm that the two groups are equivalent in a purely cognitive control task, and that the L1 does not interfere with bilinguals' performance in a general-cognitive task. By contrast, the findings of the picture naming task indicate that language processing in bilinguals is influ-
Idioms are a special case of multi-word expressions in that their meaning cannot be constructed compositionally from the meaning of the single constituents. The question of how the idiomatic meaning is assembled remains an unsettled issue in psycholinguistic research. The present study examines whether the figurative meaning of an idiom is recognized if critical idiomatic constituents, such as the noun, verb, or preposition, are modified. In three paraphrase experiments, participants saw (a) the canonical idiomatic phrase (e.g., She reached for the stars), (b) the idiomatic phrase with a modified constituent (e.g., She reached/grasped for/at the stars/planets), or (c) a matched literal control sentence (e.g., She reached for the sweets) and rated on a scale from 1 (not at all) - 7 (completely) how strongly the sentence reflected the meaning of a paraphrase of the idiom (e.g., She has always aspired to unattainable goals).

Paraphrase ratings yielded strong effects of sentence type and constituent type, with highest ratings for canonical idiomatic phrases, lowest ratings for control sentences, and ratings in between for idioms with modified constituents. Further, idioms with modified verbs were rated higher in matching the figurative meaning than idioms with modified prepositions or nouns. Overall these findings indicate that the figurative meaning was assembled in spite of the modifications. We conclude that idioms are not fully ‘semantically fixed’ but allow for some flexibility in the processing of idioms. Modified constituents that activate meanings similar to those of the canonical constituents will co-activate the figurative meaning of the idiom together with the other idiomatic constituents. We discuss psycholinguistic models on idiom comprehension.

Interpretational Diversity in Novel Compounds and What the Head Noun Has to Do with It
Melanie Bell & Martin Schäfer

Since Gagné and Shoben (1997), evidence has accumulated that humans use statistical semantic preferences associated with compound constituents in the interpretation of compound nouns. While these effects obtain for established compounds, fewer studies investigate the effects for novel compounds, and existing studies come with crucial limitations due either to the selection process or the experimental design: for example, Gagné et al. (2005) include e.g. drug therapy as a novel compound (COCO frequency = 338), while Middleton et al. (2011) use only novel combinations with 72% agreement on a preferred out-of-context interpretation, a strikingly high number for readings in isolation. In addition, most work to date has focused on the semantic relation between constituents, rather than interpretation of the constituents themselves. Yet due to the ubiquity of polysemy and homonymy, there are typically several concepts to choose from for any given constituent, and it is not clear at the outset which concept is to be used. This holds for concepts that are unrelated (plant factory/organism) as well as those that are metaphorically linked (gold material/colour), and for modifiers and heads alike. Using attested novel compounds, we show that diversity of interpretation is much greater than suggested by studies that focus only on semantic relations and that the ambiguity of the constituents, especially the head, plays an important role in determining both difficulty and diversity of interpretation.

We generated a set of attested novel compounds by selecting 45 noun-noun compounds that occur only once in ukWaC, a 2 billion word corpus of British English. Twenty native speakers of British English (10 male and 10 female) provided free paraphrases of each compound presented in isolation, in randomised orders, and rated the difficulty of doing so on a 6-point Likert scale. The paraphrases were subsequently coded and grouped according to whether or not they represented the same reading. This coding was undertaken independently by two trained coders, and differences between the two coders were adjudicated through the judgements of a third coder. We modelled the difficulty ratings (standardised by participant) using a mixed effects regression model with random intercepts for subjects and items and fixed effects for presentation order as well as various constituent-family-based predictors. These were obtained from the publicly available dataset of Bell & Schäfer (2016), which is annotated with semantic relation and WordNet synset (sense) of the constituents. We included head and modifier family sizes, number of different semantic relations in each family, and number of distinct constituent senses in each family. We also calculated the entropy of the probability distributions of the synsets and semantic relations for all
Studies of lexical processing have repeatedly shown that final phonological overlap (i.e., rhyme) facilitates access (Monsell and Hirsh 1998). This facilitation is argued to be pre-lexical, as it occurs with non-words (Dumay et al. 2001), and short-lived: observed only when the prime immediately precedes the target (Slobiaczek et al. 2000). These findings raise the question of what causes this pre-lexical facilitation to rapidly dissipate. Assuming the presence of intervening elements is the cause (Nairne 2002, McKone 1998), then the question remains as to how linguistically complex an element must be to reduce rhyme prime facilitation. In two experiments, we investigate this question and find an increasing effect of linguistic complexity on the reduction of rhyme prime effects.

Experiment 1: Our first experiment (N = 117 participants) was a continuous auditory lexical decision task investigating four types of elements with increasing linguistic complexity (tones, reversed-words, phonotactically licit non-words, and words) intervening between rhyming primes and targets. Data was analysed using Bayesian mixed-effect modelling (brms package in R) on RTs modelled using an exGaussian distribution (Balota and Yap 2011), although we report only the parameter values for the Gaussian component here. Our model included parameters for intervener type, prime type (rhyming vs. non-rhyming primes), and the corresponding interaction terms; along with control variables of gender, handedness, age, prime RT, and intervener RT. As Bayesian methods provide direct estimates of the probability of certain effect sizes, we sought to examine the probability that an effect was >10ms, below which we would not be confident in the reality of the effect. The results indicate that there is likely no priming effect with word intervener, and that reversed-words and non-words decrease both estimates of the priming effect size (if it exists) and the probability of any priming.

Experiment 2: In our second experiment (N = 129 participants), the task was changed to a Go/No-go task for words and the word intervener condition was replaced with a silent interval, thus making responses to interveners no longer required and providing us with a baseline where we would strongly expect rhyme priming to occur given the literature. Using the same methods to analyse the results, we find clear evidence for rhyme priming with the tone intervener, as it is comparable to the silence intervener, and a similar pattern whereby reversed-words and non-words show a decrease both in estimated priming effect size (if it exists) and in the probability any priming.

Conclusion: We find that intervention for rhyme prime is primarily a matter of the nature of the intervening material. Non-linguistic sounds (e.g., tones) behave like silence in failing to decrease the effect of rhyme prime. As the intervening sounds become more languagelike (from the language-like noise of reversed words to phonologically valid non-words to words) the intervention effect gets stronger. The fact that task changes influence the effect supports the theory that intervention is driven by the number of linguistic processing levels involved. A comparison across the two experiments suggests that when participants are tasked with linguistic judgments for the intervention material, non-linguistic stimuli attenuate the rhyme priming effect to a greater extent. Our results show how rhyme prime and task differences can provide insights into various modules of linguistic processing.

References
Constructing Two Vietnamese Corpora and Building a Lexical Database

Hien Pham, Benjamin V. Tucker & Harald R. Baayen

Corpus-based research has formed the backbone of linguistic research in recent decades. The exploitation of large text corpora is used for solving various kinds of linguistic problems, including those of quantitative linguistics, cognitive linguistics, and psycholinguistics. This paper reports the creation of two corpora of contemporary Vietnamese. It also describes the construction of two equally sized Vietnamese corpora (a corpus from Vietnamese film subtitles, SUBTLEX-VIET, and a general corpus of varieties of online newspapers and stories, GENLEX-VIET). We document the general steps of the construction and extraction of linguistic information from the language corpora and provide a road map for others who would like to create similar corpora. The resultant corpora are available in three versions: plain text, tokenized, and POS tagged. In the second half of the paper, the construction of a lexical database derived from the corpora is described. The database includes measures such as frequency of occurrence, dispersion, Mutual Information, Inverse Document Frequency, as well as vector space models.
Acquired to typological accounts, prepositions are a subtype of adpositions, mostly prevalent in languages with SVO order. They constitute a grammatical category expressing relations between nominals and their syntactic environments as constructions with object nominals, preceding the noun and governing its case (Talmy, 2007). For example, John sent his book on birds to Mary in 2016. As such, they are major participants in the construction of clause structure and the configuration of argument structure, and in reference tracking in discourse. In addition to grammatical features of case assignment (e.g., Hebrew Accusative et), prepositions convey important lexical information (Littlefield, 2004), carrying highly salient semantic information in the clause, mostly regarding spatial and temporal relationships (Saint-Dizier, 2006). Moreover, prepositions tend to be polysemic, with several different functions for a single prepositional form (Tobin, 2008), and they are often specified for particular lexical contexts, resulting in semantic nuances, as in English work at or work for. Despite their extreme frequency in discourse (Fang, 2000), prepositions constitute a class of words that poses lexical, semantic, syntactic and discursive challenges for young learners (Morgenstern & Sekali, 2009).

Tracking the AoA of prepositions in child language, the functions they serve, their changing distributions and the constructions they occur in can thus provide a window on the emergence of a class bearing canonical semantics in tandem with the consolidation of clause syntax (Grela, Rashiti & Soares, 2004). The current talk aimed to determine AoA for the prepositions produced by children, relating them to their meanings, via a vis the diversity of prepositions in each age group.

To this end, we turned to the analysis of a corpus of transcribed video-recorded peer talk by 75 typically developing, monolingual Hebrew-speaking children from mid-high SES containing 69,912 words in 24,605 utterances. The corpus consisted of five age groups (2.6–3.0, 3.0–3.6, 3.6–4.0, 4.0–5.0, and 5.0–6.0 respectively) engaged in 45-minute triadic conversations at their preschool (five triads per age group). All 7,718 preposition tokens in the corpus were identified and coded for their lexical semantics, morphological, and syntactic properties. Of the 162 prepositions identified in the Hebrew dictionary, children produced only 33 (e.g., to, with, on, and accusative et), 16 of which already occurring in the youngest group of 2.6-3 year olds. Token frequency of most prepositions increased with age, especially between 3 and 3.6 and between 4 and 5. The prepositions which occurred in children’s productions expressed 26 different meanings – grammatical (e.g., accusative, dative and oblique), spatial (e.g., place and goal), temporal (time, duration), and a variety of other meanings. Some prepositions had only one meaning (e.g., kmo expressing comparison), while others had multiple meanings (e.g., al ‘on’ with 12 different meanings in the corpus). While most meanings were already present for the youngest age group, their frequency increased with age, related to cognitive development – e.g., temporal meaning increased from 2 in the 2;6 year olds to 35 times in the 3;6 group. Also, the frequency of the more abstract ones increased with age (e.g., purpose). Moreover, with age, meanings acquired more prepositions to represent them (e.g., location). These findings were quantified by a diversity index (Jost, 2006) for each age group, showing that the range of prepositions, functions and syntactic environments increase with age.

References
The promotion of intercultural links in all levels of education has been an emphatic slogan of political discourse in Mexico. Actions undertaken by the government include the growing acceptance of indigenous students in urban universities; however, once enrolled, the teaching and learning process occurs in parallel conditions no matter the linguistic background of students. This is disadvantageous for those who come from rural communities where Spanish is not the native language, but a means of communication at the school domain (that is to say, except for school, most of everyday life domains develop in an indigenous language). A potential consequence of such disadvantage is school dropout. According to a 2017 report of the National Institute for Education Evaluation (INEE in its Spanish acronym), more than 50 percent of indigenous students dropped out of higher school institutions due to multiple factors, amongst which the linguistic background which made lesson understanding difficult.

Based on the above framework, this piece of research aims at determining the lexical competence of Spanish language of bilingual students enrolled in a Mexican high school specialized in Agriculture. Although entrance examination was applied, which showed these students have enough Spanish competence to understand the courses, there still seems to be strong differences between bilingual (Spanish and an indigenous language) and monolingual (Spanish) students to grasp information provided exclusively in Spanish, with a lesser level of academic success to the former.

An experiment of lexical availability was designed to measure the lexical competence of a sample of bilingual students. The exercise was based on the PanHispanic project of lexical availability (López, 2008), from which five centers of interest were obtained: parts of the body, objects and buildings in the campus, clothes, countryside, and animals. The results were compared to those obtained from a control group of Spanish monolingual students. Focus was placed on both the number of valid words produced by each group (bilingual/monolingual) and the lexical density. Results demonstrate a clear correlation between a low lexical density and the easiness to understand a passage (Bradac et al, 1977). The findings express a clear association of linguistic factors to academic success and open the discussion towards urgent actions to avoid dropout.

Concrete and Abstract Word Learning in Developmental Language Disorder: A Computational Exploration
Armand Rotaru, Alessandro Lenci & Gabriella Vigliocco

A number of theories of abstract concepts assume that they are represented in a linguistic format [1-2], in contrast to concrete concepts that would also be represented in terms of experiential (sensory-motor) features [3]. Thus, language development may play an especially important role in learning abstract concepts. There are other views, however, according to which there would not be a linguistic primacy in the learning of abstract concepts, but rather information extracted from language would play an important role in learning all types of concepts, both concrete and abstract [4-5].

Ponari et al. [6] tested these different proposals by comparing the knowledge of abstract vs. concrete words by children with developmental language disorder (DLD; [7]). DLD is an impairment in language production and comprehension, which cannot be attributed to sensory, motor, social or neurological causes. As compared to typically developing peers, children with DLD have both a smaller vocabulary and poorer word knowledge [8]. If learning of abstract words depends more on language than the learning of concrete words, children with DLD should have more problems processing abstract words, as opposed to concrete ones. However, their results indicate that DLD children did not show greater impairment for abstract than concrete words, although they showed poorer vocabulary overall than their typically developing peers.

Here, we take a different route to testing these proposals. We use a computational approach to simulate impairments in the representations of concrete and abstract words and assess whether different impairments lead to a greater “deficit” (i.e., difference from a reference model, RM) for abstract than concrete words. We employ a state-of-the-art distributional model (i.e., CBOW; [9]), trained over a corpus of child-oriented texts, in order to simulate the semantic knowledge of typically developing children (RM). We then construct several “damaged” versions of RM, by changing the values of three main parameters: the size of the sliding window, the learning rate, and/or the subsampling of frequent words. To compare our RM to the damaged models, we use representational similarity analysis [10], under the assumption that lower correlations between the models imply more severe damage.

We found that for each of the different parameters and different values for each of them, abstract and concrete words were impaired to a similar extent. This seems to suggest that linguistic information is equally important in building semantic representations of both concrete and abstract words. A final finding is that the learning rate has a stronger impact on the quality of the representations, than the size of the sliding window and the subsampling of frequent words, suggesting that, at least in distributional semantics models such as CBOW, reducing the number of words on which co-occurrences among words are calculated, or changing the weight given to less frequent words do not greatly affect semantic representations. Together with the results by Ponari et al [6] we take these findings to argue against a linguistic primacy for the learning of abstract concepts.
The words crocodile and microfilm both contain nine letters. However, microfilm seems very clearly to contain internal structure corresponding to micro+film. The extent to which this putative internal structuring plays a role in lexical processing has long been prominent in the psycholinguistic literature (Gagné, 2017).

The vast majority of evidence in this debate has come from studies of lexical recognition. We have sought to provide a new source of evidence by combining lexical recognition and production. The recognition task utilized a progressive demasking technique (Grainger & Segui, 1990) and the production tasks relied on data from typing (Libben, Curtiss & Weber, 2014) and handwriting. A key feature of the research is that stimuli were tested in two languages, English and French, in unilingual settings. Crucially, the English and French words were cognates, with the specific characteristic that they are written identically in the two languages. There were four categories of stimuli, as shown in Table 1.

Table 1. Categories and stress patterns for visually identical English and French stimuli

<table>
<thead>
<tr>
<th>Category Example English stress French stress</th>
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<tbody>
<tr>
<td>Monomorphemic crocodile cróciodile crocodile</td>
</tr>
<tr>
<td>Stem-stem microfilm microfilm microfilm</td>
</tr>
<tr>
<td>Stem-suffix placement placement placement</td>
</tr>
<tr>
<td>Prefix-stem impatien impatien impatien</td>
</tr>
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</table>

The use of these stimuli enabled us to examine both the recognition and production of words across languages in a manner that held visual form constant, but in which phonological surface form differed, as did lexical statistics such as frequency and productivity. Forty native speakers of French and forty native speakers of English participated in the experiment. Each participant recognized and produced a total of 100 words. Results showed the following patterns:

(a) Recognition and production latencies were correlated such that those words that participants took longer to recognize were also words that they took longer to produce. This suggests that progressive demasking performance and written production are drawing on common processes.

(b) Participants’ per-letter production times reflected morphological structure such that letters that were at and immediately preceding putative morpheme boundaries took longest to produce. This suggests the use of morphological structuring in production planning.

(c) Although overall results showed similar patterns in both languages, language-specific effects were evident. These included patterns that aligned with stress and frequency differences.

To conclude, the evidence above supports a view in which morphology comes into play during word production and in which processing is modulated by experience-specific factors.

References


The cross-linguistic asymmetry of affixation with respect to structural properties, combinatorial constraints and frequency, is well-attested (cf. Sapir, 1921; Plank 1988). Evidence for this asymmetry is apparent in psycholinguistic research. For example, while prefixed words regularly prime morphologically-related affixed forms and stems, configurations containing suffixed words reveal less evidence of facilitation, particularly when the suffixed word is a visual target (cf. Grainger et al., 1991, Marslen-Wilson et al., 1994). We propose that this asymmetry is not necessarily due to differences in perception, reading, or inhibition from the phonological cohort, but also attributable to the salience of the morpheme boundaries of affixed-word representations during recognition. Simply put, decomposition of prefixed words is more straightforward than that of suffixed words because cohesion between stem and suffix is greater than that between stem and prefix. To investigate this, we conducted five cross-modal priming experiments in Bengali, a language rich with derivational morphology.

Lexical access to a word is known to be influenced by the word’s relation to the other words. These words carry information through different channels - inflectional paradigms (a.m.o. Lõo et al., 2017), derivational family size (a.m.o. Moscoso del Prado Martin et al., 2004), semantic neighbourhood (a.m.o. Feldman et al., 2015). Derivational families in morphologically rich languages are the material to investigate the interaction between these types of information.

Russian builds new words using both prefixation and suffixation, but the lexical properties of the derived words differ depending on these processes: Prefixation usually preserves all inflectional properties of the verb (except for the aspect) and results in relatively unpredictable semantic changes. Suffixation, however, is semantically more predictable but always changes the inflectional class. Additionally, preliminary corpus study shows the dominant form of the prefixed verb is that of the participle. On the contrary, suffixed verb primarily appears in the fully inflected form which is comparable to the syntactic behaviour of the base verb. This suggests a functional difference between the two relative forms. Based on these differences in distribution, we expect that suffixed and prefixed primes will interact differently with the syntactic information carried by the base form.

Materials. 20 verbs and their suffixed and prefixed relative forms. The derivative verbs were balanced in terms of their token frequency and length. We computed the frequency distributions of the base form of each verb across syntactic dependencies for which the target verbs serve as modifier in the largest available dependency treebank of Russian (Syntagrus; > 1M words). We measure the syntactic information carried by these distributions using the conditional entropy. This measure allows us to isolate syntactic information from the information carried by the specific lexical items that are syntactically bound to the target (i.e. collocational information). We refer to this measure as “modifier diversity.” Crucially, we expect the participial bias of prefixed forms to reflect modifiership, and hence to interact with modifier diversity of the target. We bin the entropy measure into three groups based on proportion of observations: low, medium, and high.

Method. We performed two masked-priming lexical decision experiments with with prime duration of 150ms and 60ms. Primes were derived verb forms; targets were infinitival stems. Participants. 150ms: 47 & 60ms: 39 speakers of Russian (age: 18-55, 37F & 30F). Results. A preliminary analysis revealed no difference in the effects for each condition, so we fitted mixed effect regression models on merged 150ms & 60ms RT data.

The effect of the prefixed and suffixed relative verbs is identically facilitative given the low and medium syntactic diversity of the target verb. However, we find a significant difference between the two prime conditions for high modifier diversity of the stem verb: suffixed primes produce a processing advantage of around 100ms (df=4, F=2.75, p=0.026). Comparison against morphologically unrelated primes confirmed that the effect is indeed one of facilitation for the suffixed primes.

Our results indicate an interaction between the syntactic usages of affixed verbs and its role within the stem’s derivational paradigm. Future research with larger corpora and diversity measures for all members of the derivational family is needed to provide a more accurate explanation.

References

Although auditory priming prima facie seems similar to overt visual priming, the temporal and sequential nature of auditory input makes it potentially similar to masked priming. Unlike visual stimuli, which are processed bidirectionally from left to right and right to left, auditory segments get instantly ‘masked’ by their following segments. We present two auditory-auditory priming experiments showing that not only English truly morphologically related words (e.g., teacherteach), but also pseudo-complex words like corner prime their stem corn. This provides evidence for early form-based decomposition in the auditory rather than visual modality. We further show that these effects need to be distinguished from purely phonologically related pairs (cashew-cash).

**Background** In visual masked priming, English pseudo-complex prime-target pairs yield priming effects equal to truly morphologically related pairs, unlike phonologically related pairs (Beyersmann et al. 2016; Longtin et al. 2003; Marslen-Wilson et al. 2008; Rastle et al. 2004; i.a.), and unlike results from overt visual priming experiments (Marslen-Wilson et al. 1994). These findings are taken to show a level of representation accessed in early word recognition at which morphological decomposition is defined purely form-based such that words are segmented if they (appear to) have a morphological structure. It is unclear if these effects are merely an artifact of orthographic representations, or whether these early decomposition effects also exist in auditory processing.

**Experiment 1** includes prime–target pairs that are morphologically and semantically related (MS: creamy-cream, treat-treat), pseudo-morphologically but not semantically related (M: bellybell, pigment-pig), phonologically related but morphologically undecomposable (Ph: dogma-dog, pillow-pill), and semantically related (S: garbage-trash, painting-art). Each related prime was matched with an unrelated prime. Our conditions were carefully controlled with different suffixes appearing equally often in M and MS, and targets being orthographic and phonological substrings of their prime (e.g., excluding leg-ion-). Participants were 39 native speakers of English. Linear mixed-effects models were used to analyze log-transformed response times (RTs) to correct targets after minimal a-priori data trimming and model criticism. Fixed effects were TARGET TYPE (MS, M, Ph, S) and PRIME TYPE (related, unrelated) and their interactions, TRIAL NUMBER, TARGET and PRIME FREQUENCY, ISI, TARGET DURATION, and LOG PRIME RT. We included random intercepts for SUBJECT, PRIME, and TARGET. Significant priming effects (related vs. unrelated) are present in all conditions (p<0.001 for MS, M, Ph, S). The model also shows a significantly greater priming effect in the MS condition than in the M (p=0.022), Ph (p=0.003), and S (p<0.001) conditions, while no difference is found between M and Ph (p=0.482).
Experiment 2 explores whether, at 1-lag, different processing patterns between M and Ph can be distinguished. Methods are the same as Exp1, except that half of the stimuli were presented at 0-lag and the other half at 1-lag with a non-word as an intervening item. Subjects were 80 native speakers of English. The results at 0-lag replicate our Exp1 results, with significant priming effects in all conditions. At 1-lag, we still find a significant priming effect for MS (p=0.008), while no significant effects are found for the other conditions. However, a three-way interaction between TARGET TYPE, PRIME TYPE, and DISTANCE (0, 1) reveals a significantly greater decay in priming between 0-lag and 1-lag for M compared to the decay in priming for Ph (p=0.027).

Discussion Our 0-lag results show priming effects in both M and Ph. This indicates the existence of early form-based decomposition in the auditory domain, similar to what has been shown in the visual domain. This thus suggests that the effect is not just orthographic. The use of lag in Exp2 shows that our M and Ph conditions can be teased apart based on a significantly stronger decay in priming between 0-lag and 1-lag for M, compared to Ph. Potentially, M stems are inhibited due to listeners realizing that the primes are merely pseudo-complex. Our paper will also discuss the M versus MS effects.

References

Shorter Phone Duration Facilitates Isolated Spoken Word Recognition
Catherine Ford, Filip Nenadić, Daniel Brenner & Benjamin V. Tucker

Contextually predictable, high frequency, competitor-dense words are often produced with less phonetically contrastive categories in spontaneous speech (Plug, 2011; Gahl et al., 2012; Tucker & Ernestus, 2016). Often this predictability manifests through changes in phone duration, with shorter duration relating to less careful speech (Gahl et al., 2012). Initial observations point to temporal variation occurring even in isolated words produced in controlled settings, such that variation is found in both conversational speech and isolated word productions. The present study investigates the role of temporal variation in the recognition of isolated words. Since additional context is lacking for isolated words, it is hypothesized that either (1) loss of information (shorter durations of individual phones) will be associated with more difficult processing, or that (2) durations that are uncommon for a particular phone (both long and short) will inhibit processing. Phone durations were extracted from 26,800 words from a full range of word types produced in isolation by a single male speaker recorded as part of the Massive Auditory Lexical Decision (MALD) dataset. A number of measures of temporal variation on the word level were then calculated (e.g., word mean standardized phone duration, standardized duration of the shortest phone in the word, proportion of “reduced” phones, i.e., phones in the word that are -0.75SD away from their phone grand mean or shorter). Auditory lexical decision responses from the MALD sample of 232 native listeners of English were analysed using generalized additive mixed modeling. Temporal variation measures were assessed based on their contribution to models predicting participant response latencies, while controlling for other relevant psycholinguistic variables. The results indicate that after controlling for word duration and uniqueness point that these measures are predictive of response latencies and that the mean standardized phone duration of a word is the most predictive of response latencies of the measures tested. However, the two hypotheses are not supported, as shorter phones are found to facilitate word recognition, implying that information was not significantly reduced. These results support a view of the lexicon which allows listeners to store distributional information at the level of individual speech sounds.

References
In this talk, we present the results from an Event Related Potentials (ERP) study on the processing of anaphoric reference to quantified expressions (QEs) in Swedish. QEs pick out proportions of possible members of some set for which a property holds. In (1a) and (1b), for example, some or few members of the set of students attended the lecture.

(1) a. Some students attended the lecture.
   b. Few students attended the lecture.

Some and few differ in polarity: some is positive (upward entailing) while few is negative (downward entailing) (Peters and Westerståhl, 2006) and this is of importance when referring back to the QE using anaphoric expressions. The sentence in (1a) is naturally followed by (2a), which is about the students attending the lecture (the reference set, refset). The sentence in (1b), in contrast, is naturally followed by (2b), which is about the students not attending the lecture (the complement set, compset) (e.g. Moxey and Sanford, 1987). While (1b) can in fact be followed either by (2a) or (2b), (1a), cannot be followed by (2b).

Filik et al. (2011) is one of few studies of anaphoric reference to QEs in English using online measures (ERP). They report results for positive and negative QEs separately. Each type of QE shows refset and compset eects, as described above, on the disambiguating word. A larger N400 for compset vs. refset continuations for posivive QEs, and the opposite for negative QEs. However, they do not report any results for the contrast between positive and negative QEs in the compset condition. Since this is a very important condition and since it is known that QEs dier across languages (Nouwen, 2010; Tsai et al., 2014), we investigated this issue for Swedish.

160 experimental items of four sentences each were manipulated along two dimensions: polarity (positive vs negative quantifier, några vs få in (3)), and set (refset vs compset targeting disambiguating adjective, duktiga vs dåliga in (3)). The quantiers included were: några (`some'), få (`few'), många (`many'), inte många (`not many'), alla (`all'), inga (`no'), nästan alla (`almost all'), inte alla (`not all').

(3) Några/Få studenter skrev bra på tenan some/few students wrote well on the-exam igår och att decCW var så yesterday and that they were so

duktiga/dålgaCW förbryllade professorn.
good/bad confused the-professor

There were four lists with 40 sentences from each condition. Each participant (29 in total, results reported below based on the rst 13) only saw one sentence from each item, but saw all types of manipulation. In total, each participant read 400 sentences (160 test items, 240 llers).

Unlike Filik et al. (2011) we found that positive QEs showed a pronounced positivity over the central region (FCZ, CZ, CPZ, PZ) in the compset condition relative to negative QEs, in the P600 time span (500-800 ms) after the onset of the critical word (the disambiguating adjective, `bad'). A linear mixed eects model analysis (LmerTest) showed a highly signicant main eect of polarity in the central region and the P600 time span above. We interpret this to mean that for positive QEs, a new discourse referent needs to be introduced following compset reference, while for negative QEs this discourse referent is already available (Burkhardt, 2007).

References
Verb senses are often understood to denote event categories. But a single verb sense can denote several event categories. For example, an event where someone raises a glass in celebration (a toast) and an event where a crane raises a truck out of a lake are unlikely to be categorized together. In this paper, we explore the hypothesis that a verb sense does not denote a single event category, but rather a function from properties of event participants to various event categories. This view augments extant verb-centered work on event categorization (e.g. Vinson & Vigliocco, 2008). While the contribution of non-verb cues has been recognized (see e.g., McRae et al., 2005, Elman, 2009), the identification of those cues and their roles in categorization is lacking. In this paper, we tackle two questions: (1) which properties of event participants matter for distinguishing event categories, and (2) what is their relative importance across different semantic domains? To answer these questions, 120 participants each sorted 6 sets of 20 sentences into categories based on how similar the events they described were. They then indicated the features used in sorting sentences into categories. The 480 sentences that were sorted were pseudo-randomly selected from the American National Corpus. Sentences included one of 24 verbs selected because they were included in the COCA 1,000 most frequent English verb list and because they were balanced across 6 semantic domains: feeling, physical action, perception and mental attitude, movement, possession, and change of state. Each set of 20 sentences included one of the 24 verbs. Crucially, verb sense was held constant across sentences for each verb in each set. The approximately 2,000 unique elicited features were then condensed via k-means clustering into an optimal number of feature clusters based on their semantic similarity. Two optimal clusterings resulted: one with 11 clusters using the Hartigan index, and one with 31 clusters using the SDbw index. These ‘standardized’ features were ranked according to both their frequency of use and their distinctiveness as measured by cue validity. A series of mixed effects logit regressions suggested that 5 of 6 semantic domains were significant predictors for the increased likelihood of specific standardized features being used (see Table 1). The results of our sorting and feature elicitation task suggest that speakers do use event participant properties to map verb senses into distinct event categories and that which properties are used and matter most vary across semantic domains. Many
of the features identified by participants correspond to event features already recognized in the literature as important, such as agent type (animals, people), complexity (groups vs. individuals), and sociocultural salience (government/military/politics). Furthermore, the importance of animacy, humanness, and plurality in participants’ sorting suggests that the use of these properties in inflection and in agreement patterns might be rooted in their relevance to event categorization.

References

The Origins of Sound Symbolism
Angeliki Athanasopoulou, David Sidhu, Stephanie Archer, Suzanne Curtin & Penny Pexman

Sound symbolism involves a non-arbitrary association between sound and meaning. The most extensively studied example of sound symbolism is the bouba-kiki effect, the bias adults and children show in associating round objects with words like “bouba” and spiky objects with words like “kiki” [1-3]. While some accounts propose that very young infants are sensitive to sound symbolic mappings and use those mappings to start acquiring language [4,5], others have argued that sensitivity to sound symbolism emerges only with development since it is the result of our experience with the environment and/or language [6]. In the present study, we investigated the developmental origins of the bouba-kiki effect to answer whether sound symbolism is a biologically endowed aspect of perception or it emerges with language exposure. More specifically, we tested 23 4- to 5-month-old infants in a preferential looking paradigm. On each trial, infants saw two pictures on the screen, one with a round shape and the other with a spiky shape (Fig.1) while listening to a label that would be associated with a round object (boobo or lulul) or a label that would be associated with a spiky object (cheechee or kaykay). There were 8 trials per participant (12 seconds/trial), 4 were paired with a “round” label and 4 with a “spiky” label. We calculated the percentage of looking time to the round and the spiky objects for each trial and excluded trials with less than 17% of looking time on the screen. The results (Fig.2) show that 4-month-olds look longer to the spiky object when they hear a “round” and when they hear a “spiky” label (62%-63%), indicating no sensitivity to sound symbolism. Overall, our data do not support the biological endowment of sound symbolism [4,5], but do support the emergence of the effect with development [6]. That is, it is still possible that sound symbolism is used as a scaffolding mechanism in word learning, but in later stages of language development [2,4,5].

References

How Acoustic Distinctiveness Affects Spoken Word Recognition: A Pilot Study
Matthew C. Kelley

In the present study, I propose an acoustically-based alternative to the concept of phonological neighborhoods. The concept of phonological neighborhoods is exemplified in Luce and Pisoni’s (1998) Neighborhood Activation Model of word recognition, where words that sound similar are predicted to compete for activation during the process of recognizing a word, regardless of where the differences are. So, in this model, if a listener is hearing the word cat, both bat and cad are predicted to be competitors, even though bat differs from cat at the first phoneme, and cad differs at the last one. Based on this model, Luce and Pisoni cautiously claim that the lexicon may be structured into phonological neighborhoods. A phonological neighborhood would comprise, they say, lexical items that sound similar. The concept of phonological neighborhoods has subsequently been used in a number of studies, which Vitevitch and Luce (2016) review extensively. These studies often model phonological neighborhoods using phonological neighborhood density, which is usually defined as the number of words in a reference lexicon that differ from the word in question by exactly 1 phoneme, whether by addition (cat and...
cats), deletion (cat and at), or substitution (cat and bat) (Gahl & Strand, 2016; Vitevitch & Luce, 2016).

However, phonological neighborhood density makes a simplifying assumption that all potential phoneme additions, deletions, or substitutions impact the acoustic signal equally, which is hard to believe. It also presumes that the lexical representation of a word is a string of phonemes, which Port (2010) has called into question. Finally, it is difficult to interpret phonological neighborhood density values in terms of acoustics, even though acoustics must form the basis of the process of spoken word recognition. As such, I propose a measure that operates on recordings of words and compares them acoustically, rather than in terms of phoneme strings. For any two recordings, the measure is calculated by comparing acoustically similar portions of each word to each other. It then returns an overall divergence value of how distinct the compared sections of audio are. The overall distinctiveness value for a word is then taken as the mean of its divergence from every other word in a reference lexicon. For the present study, I used the nearly 27,000 recordings of words from the Massive Auditory Lexical Decision database (Tucker et al., submitted) to calculate the overall acoustic divergence for each item in the database. For modeling purposes, I used the response times from the auditory lexical decision data contained in the same database. The research question is, thus, how does this acoustic distinctiveness value compare to phonological neighborhood density?

In a linear mixed-effects regression model, greater acoustic divergence values predict faster response times, suggesting that words that are overall more acoustically distinct are easier to recognize. In terms of lexical competition, more distinct words should have fewer competitors, aiding the listener in recognizing the identity of a word. With these results, I explore how to explain phonological neighborhood density in terms of acoustics. Principally, words with high phonological neighborhood density values are said to have more potential competitors and thus take longer to recognize (Luce & Pisoni, 1998), which relates to the finding from this study that less distinct acoustically distinct words take longer to recognize. Armed with an acoustically-based explanation of phonological neighborhood density, I conclude by exploring what a revised concept of phonological neighborhoods based on acoustics implies about the structure of the lexicon, with some attention paid to whether the spatial metaphor implied by “neighborhood” is still appropriate. In so doing, form-based lexical competition measured by phonological neighborhood density can be related more easily back to the acoustic signal.

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### The Role of Noun vs. Verb Templates in Visual Word Recognition in Hebrew

Marina Oganyan, Richard Wright & Julia Herschensohn

This study investigates the role of the template in word recognition in Hebrew by examining letter position flexibility of the root in verbs versus nouns using the masked priming paradigm. In combination with previous research, these results indicate that the template plays a larger role in verbs than it does in nouns. The difference in the contribution of the template may relate to morphological productivity; there is a restricted set of templates used in verb morphology, while there is a vastly larger set of templates used in noun morphology.
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