Mental Lexicon Conference Abstract Booklet

Day 1: October 12, 2022
Platform Session 1.1

Title: Covid-slide in reading-related skills of university students: Who and what slide more?
Authors: Esther Geva and Victor Kuperman
Purpose: The COVID-19 pandemic brought an abrupt change to the delivery of academic instruction and learning environments. This paper asks what consequences (if any) this change has had for literacy and language skills among undergraduate university students. We aim to identify the skills that changed the most compared to pre-pandemic levels, and the student groups most vulnerable to the change, with an emphasis on L1 vs L2 speakers of English.
Method: In this cross-sectional study, 1762 undergraduate students in a Canadian university completed tests of reading comprehension, spelling, and vocabulary. Year 1 of the study (academic year 2019-20) preceded the pandemic (104 L1 speakers), while data from Years 2 (903 L1 and 165 L2 speakers) and 3 of the study (N = 411 L1 and 133 L2 speakers) were collected during the pandemic, when all instruction was administered remotely. We estimated group differences over time using linear multiple regression models.
Results: Vocabulary scores of L1 speakers during the pandemic (Years 2 and 3) were significantly lower than those in the pre-pandemic Year 1 (both Cohen's d ≈ 0.39). Conversely, reading comprehension and spelling performance remained at the pre-pandemic level for L1 speakers of English throughout Years 13. While the pre-pandemic comparison is absent for L2 speakers in our sample, we observed a disproportionately steeper decline in reading-related skills of L2 speakers than among L1 counterparts. Notably, between Years 2 and 3, vocabulary scores of L2 speakers decreased by d = .70, such that the L1 advantage in vocabulary scores increased from d = .86 in Year 2 to d = 1.56 in Year 3. There was also a decline (albeit less steep) in reading comprehension and spelling scores for L2 students between Years 2 and 3 was d = .37 and .64, respectively. Other demographic covariates (age, gender, years at university) did not show significant effects.
Conclusion: Of all skills under consideration, vocabulary knowledge reflected most distinctly the immediate impact of the pandemic, both in the L1 and L2 student groups. The stunted vocabulary growth in young L2 adults during the pandemic may stem from both disrupted exposure to formal instruction in English, and relatedly, drop in the scope and diversity of their day-to-day oral and written communication opportunities. Reading comprehension and spelling skills may be more resilient to change or perhaps the amount of reading remained stable during the pandemic. The steepest skill slide was observed in the vocabulary of L2 speakers of English. It is possible that a Covid-slide effect on other reading components may emerge - eventually. This decline may reflect reduced exposure to English of international students in non-English-speaking environments, while studying remotely, thus being deprived of the English language experience afforded by immersion. The study cannot disentangle additional effects attributable to change in instruction delivery from demographic and socio-economic effects of the pandemic on student enrolment, attrition, and physical and mental health. It does present a cross-sectional snapshot of the current student body and the dynamics of their reading-related skills before and throughout the pandemic.

Title: Emergence of Covid-19 as a novel concept has shifted existing semantic networks
Author: Charles Davis

Semantic knowledge is dynamic and fluid – the way humans represent semantic knowledge changes as a function of diverse contextual factors at multiple timescales (e.g., Yee & Thompson-Schill, 2016). It follows, then, that semantic knowledge should show demonstrable changes when large-scale contexts systematically shift our experience with the world. The Covid-19 pandemic has not only produced such systematic changes, especially related to our emotional and social experiences, but also introduced a novel concept – COVID-19 – into our collective knowledgebase (e.g., Mazzuca et al., 2021). Here, we consider the implications of these changes for how semantic knowledge is structured, predicting that the pandemic has had downstream consequences for the structure of semantic knowledge.

Determining whether the structure of semantic knowledge has changed since the introduction of COVID-19 into our collective knowledgebase requires a baseline, pre-Covid assessment of semantic knowledge. While we cannot conduct laboratory experiments retroactively, naturally occurring datasets offer a window of insight into the past, and how events have dynamically shaped the past into the present (Goldstone & Lupyan, 2016; Paxton & Griffiths, 2017). One linguistically rich naturally occurring dataset is the social media platform Twitter, which is a dynamic environment where people communicate about the world around them. It captures national and global trends, and is therefore an ideal naturalistic environment to examine how people deploy semantic knowledge (measured as language usage statistics), and how semantic knowledge changes as a function of changing social contexts.

We investigated shifts in semantic networks (e.g., Kenett et al., 2014; Wulff et al., 2021) as a function of the Covid-19 pandemic, and specifically, as a function of the emergence of COVID19 as a novel concept. The semantic networks were constructed based on language statistics extracted from Twitter posts (tweets) referring to pre-selected emotion- and social-related words (e.g., FEAR) over a 14-month period, with four 2-month-long timepoints (T0, T1, T2, T3) chosen based on their proximity to pandemic onset, which was defined here as the day Canada closed its international borders and the first stay-at-home order in the United States (March 16, 2020). We used a network analysis approach, and hypothesized differences in the semantic networks of emotion- and social-related concepts, attributable to the emergence of COVID-19 as a concept, between the baseline (T0) and pandemic (T1–T2) periods, and that those changes would be maintained at a later timepoint (T3). That is, the effect of Covid-19 would be sustained, and the semantic networks of emotion- and social-related concepts would not return to a baseline (T0) pre-pandemic state even at a more distant follow-up 6 months later (T3).

As predicted, semantic networks for concepts related to our emotional experiences with Covid-19 (i.e., emotional concepts like FEAR)—but not for unrelated concepts (i.e., animals like MONKEY)—showed changes that were predicted by a semantic network for COVID-19. This suggests that the emergence of COVID-19 as a concept and its associated emotional and social experiences introduced changes to semantic networks for existing concepts, changes which persist even 6 months after the onset of the pandemic. The results demonstrate the fluidity of semantic knowledge, showing that semantic networks dynamically adjust to large-scale shared contexts.

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Title: Exploring semantic organization across mental lexicons: Perception verbs in Mandarin and English

Authors: Yi Yang and Harald Baayen

Verbs of perception tend to have many shades of meaning (Viberg, 1983; Marco and Jansegers, 2019). This study addresses perception verbs from a cross-linguistic perspective, comparing Mandarin Chinese and English. We made use of distributional semantics (Landauer and Dumais, 1997), taking pre-compiled word embeddings obtained with fasttext (taken from Mhttps://fasttext.cc/docs/en/crawl-vectors.html) as starting point for our analyses.

As a first step, we defined a series of categories comprising concrete nouns (for, e.g., food, animals, and persons), as well as evaluative adjectives, modal verbs, cognitive verbs, time expressions, and onomatopoeia. Furthermore, we defined a highly cultural specific category comprising words for supernatural beings. For Mandarin, we also included the philosophical terms 阴 yin, 阳 yang, and the 5 elements (五行 wu-xing).

As a second step, we then used t-SNE (Maaten and Hinton, 2008) to investigate how the perception verbs are positioned with respect to the clusters comprising the words of the above categories. The t-SNE maps for the categories in Mandarin and English show both similarities and differences. Focusing on the perception verbs (and within the set of perception verbs, specifically the vision verbs), we observed that they are more similar to the cognitive verbs, the modal expressions, and the adjectives, all of which are categories expressing the speaker's attitudes. The perception verbs are positioned further away from categories containing words for food and plants. Compared to English, the Mandarin perception verbs have embeddings that are more similar to words for supernatural beings and philosophical concepts. Conversely, English perception verbs are positioned close to the onomatopoeia.

For the contrastive analysis, we made use of pairs of translation equivalents, and calculated, for each pair, the Jaccard index of the 20 nearest neighbor translations. That is, we calculated for each pair the ratio of the number of shared translation neighbors to the total set of neighbors in both languages. Of all semantic categories, the perception verbs differed the most between the two languages with respect to their similarity neighborhoods.

A second contrastive analysis was based on the correlations of the embeddings of the perception verbs with the embeddings of the words in the different categories. For each language, and for a given category, we calculated the mean of the correlations of all the word embeddings of perception verbs with the word embeddings of all the words in that category, henceforth mean by-category correlation. Mean by-category correlations were very similar in the two languages for modals, diverged substantially for dynamic verbs, communication nouns, and person nouns. Surprisingly, mean by-category correlations are almost always higher for Mandarin. Perception verbs also show language-specific category preferences. For example, 观看guan-kan is typically used in the context of sports. In English, sound and smell show marked preferences for evaluative adjectives.

In conclusion, the method proposed in this study makes it possible to trace subtle differences in verbal semantics across languages.

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Poster Session 1.1

Title: Conceptual chaos: Semantic effects in adjective-noun phrases

Authors: Tara McAuley & Lori Buchanan

Semantic processing of familiar and novel modifier-noun phrases involves integrating two conceptual representations to construct a combined meaning (Ran & Duimering, 2009). From the lens of a language-based model, such conceptual representations are acquired from our social environment and formed via co-occurrence patterns in language (Durda & Buchanan, 2008). This framework derives quantifiable measures of semantic neighbourhood density (SND) and assumes conceptual abstractness is qualitatively unique from concreteness (e.g., Crutch & Warrington, 2005). Prior research has largely focused on conceptual combination of concrete noun-noun phrases (e.g., Maguire et al., 2010) whereas parallel investigations in abstractness and complex adjective-noun phrases is sparse. The current research examined the lexical and semantic processing of concrete (fizzy soda) and abstract (witty sarcasm) adjective-noun phrases (ANs) varying in phrase meaningfulness (low, intermediate, high) and constituent SND across three tasks with different semantic demands. Results from the shallowest double lexical decision task (DLDT) with orthographically illegal nonword pairs were significant for orthographic effects, with response latencies driven by combined letter length and mean orthographic frequency of ANs. In a separate DLDT with orthographically legal nonword pairs, a main effect of meaningfulness was observed, with faster response times observed for high meaningful ANs compared to low meaningful phrases, though neither significantly differed from the middle meaningful group. A typical concreteness effect was observed only within the low meaningful ANs, whereas orthographic effects were demonstrated in high and intermediate meaningful ANs. In the deepest semantic task, participants had to make sense/nonsense judgments, and in essence, conceptually combine concepts to make sense decisions. Expected main effects of meaningfulness and concreteness were observed in sense and nonsense judgments. Both facilitatory and inhibitory SND effects were found and asymmetrically driven by modifier or noun constituents, depending on the meaningfulness of the phrase. A semantically dense modifier facilitated meaning construction of high meaningful ANs. In contrast, intermediate meaningful phrases were sensitive to noun SND, with slower sense judgments observed when the head noun was semantically dense. Likewise, intermediate meaningful phrases were quickly rejected when both constituents were semantically dense. Lastly, low meaningful ANs were sensitive to semantic richness in a graded fashion, similar to findings in adjective-noun metaphors (Al-Azary et al., 2021). Low meaningful phrases benefitted from a degree of semantic richness, as faster meaning construction was observed for concrete ANs relative to abstract ANs with a semantically sparse modifier, or when both constituents were semantically dense. In contrast, when ANs were too semantically rich, such as concrete ANs with a semantically dense modifier, these phrases were most quickly rejected as sensical. Taken together, semantic effects were increasingly observed with deeper semantic engagement across tasks and stimuli. Slower meaning construction was observed for abstract ANs, particularly with a semantically sparse modifier, highlighting the relevance of including abstractness in models of conceptual combination. The cluster of SND findings support language-based models of conceptual representation and are aligned with Al-Azary et al. (2021) findings. A meaning construction process in AN conceptual combination may be parsimoniously modelled by Kintsch's (2000) predication algorithm, which proposes that meaning occurs via a function of co-activation of conceptual representations and a search-and-inhibit process of shared and irrelevant neighbours.

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Title: Role of emotion and concreteness in perception of scientific and conspiracy texts

Authors: Nadia Lana, Victor Kuperman

Purpose: Effective public engagement with science is a growing concern in today's age of misinformation. Yet there is little understanding how misinformation and conspiracy texts are read and understood compared to scientific evidence. Psycholinguistic lexical variables, such as the sensorimotor and affective dimensions of text, have been found to influence fluency and comprehension of text processing as well as attitudes towards content. This study examines how incorporation of words rated high in concreteness and high in positive or negative affect can affect reading and understanding of scientific and conspiracy texts.

Method: 100 adult English speakers were recruited through an online crowd-sourcing platform. In the reading phase, participants were asked to read shorts texts (conspiracy theories vs. scientific evidence) on ten topics. These texts were manipulated to vary in degree of concreteness and affect contained in the text. After each text, participants were asked about their comprehension of the text and how trustworthy they found the text. After the reading phase, participants completed a modified survey on beliefs and relationships with science (FINSCI, 2021) to evaluate individual differences in level of belief in conspiracy and trust in politics/ government. The independent variables are the concreteness (abstract, concrete) and affect (positive, neutral, negative) of the linguistic context. The dependent variables are the results of the comprehension and level of trust questions.

Hypothesis: Texts with words that are higher in concreteness and affect will be rated as more trustworthy and have better comprehension.

Conclusion: While the data analysis is under way, preliminary findings confirm our hypothesis. Both the texts representing conspiracy theories and valid scientific evidence were rated higher and comprehended more accurately if they contained more concrete and emotionally loaded (rather than neutral) words. Implications for public messaging and "fake news" disseminations are discussed.

Title: Is there a cognate effect for cognates that only exist in non-native languages?
Authors: Lisan Broekhuis and Dominiek Sandra

Research problem: A central question in bi- and multilingual research is whether bi-/multilinguals access their mental lexicon in a language selective or non-selective manner (Beauvillain & Grainger, 1987; Dijkstra et al., 1999; Gerard & Scarborough, 1989; Grainger & Beauvillain, 1987). Can they inhibit languages (top-down) that are irrelevant in the linguistic context or are lexical candidates from all their languages automatically activated (bottom-up) upon reading a word? Many studies suggest that lexical access is language non-selective, as they report cognate effects for words shared between the L1 and L2 (Dijkstra et al., 1999; Lemhöfer & Dijkstra, 2004; Van Hell & Dijkstra, 2002). However, it is problematic to draw a general conclusion from these findings. Indeed, L1 cognate readings are hypothesized to have a "special status" in individuals who learn a second language "because of the key role they play in L2 vocabulary acquisition" (Midgley et al., 2011). Since there may be a qualitative distinction between the L1 and languages learned later in life (Aparicio et al., 2012; Hernandez et al., 2005), our aim was to establish whether cognate effects also arise for cognates that lack this "special status" by definition, i.e., words shared between two nonnative languages (L2-L3 cognates).

Method and results: In our English (L2) lexical decision task (Experiment 1) with native Dutch speakers, the two critical item sets were Dutch-English (L1-L2) and English-French (L2-L3) cognates and their controls. We compared English-French cognates with a high-frequency reading in French but a low-frequency reading in English (e.g., "assassin") with monolingual English controls matched on English frequency. Contrary to our hypothesis, no facilitation was observed for the L2-L3 cognates, only for the L1-L2 cognates. One possibility is that the L2-L3 cognates were "too French" and too infrequent in English, and thus created problems for the recognition as an English word in an English LDT. In Experiment 2 we optimized the conditions for detecting a cognate effect (if that exists) for L2-L3 items. We used English-French cognates with equally frequent readings in both languages. Together with Dutch-English cognates, they were the critical items in a generalized lexical decision task. The stimulus list included both monolingual English and monolingual French controls. We found cognate facilitation for both the Dutch-English and the English-French cognates.

Conclusions: Our study provides further support for the hypothesis that multilinguals access their mental lexicon in a language non-selective manner. The results suggest that an L2-L3 cognate effect is only measurable in an L2 task if the cognates' frequencies in the L2 are higher than in the L3. Additionally, the observation of cognate facilitation for L2-L3 cognates indicates that cognate effects cannot be (fully) attributed to a supposed "special status" of L1 cognate readings. Finally, it shows that cognate effects can even occur in two languages that were learned later in life and in which multilinguals are less proficient than in their native language.

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Topic: The Politics of Language: How Perspective Shapes Semantic Space
Authors: Shaun Tessier, Catherine T. Kwantes, Chitra Rangan, Lori Buchanan

Computational modeling of semantic memory has identified a wide range of cognitive phenomena, including word categorization, semantic priming, and the removal of proactive interference.
Conventionally, the texts input to these models have been curated to represent the average individual's language experience. While this makes it possible to formulate hypotheses that can be generalized, it does not take into account situations where individuals have different semantic representations. For example, a word such as CAT may have very different meanings to a veterinarian, an allergist, or a pet owner. These different meanings are likely to be represented in the speech and the reading materials encountered by each of the individuals. The use of a generalized corpus prevents the generation of hypotheses specific to an individual's language experience. Previous research by Aujla (2021) validated corpus-specific hypotheses using representations specific to news sites. We took this as a starting point to compare the semantic space of indigenous-relevant words in two related corpra: CBC Radio and Indigenous CBC Radio transcripts.
Our data, produced through analysis using Word2vec (Mikolov 2013) machine learning, show that Indigenous and non-Indigenous media produce distinct, systematic word association patterns for the same concepts/terms. Multi-dimensional scaling of word vectors generated using the random permutation model provides a clear picture of the extent to which relevant cultural importance shapes the semantic space of news broadcasts which in turn is likely to shape the semantic space of listeners.

This study provides a bridge between semantic space models and abstract representations of Indigeneity between news outlets and provides us a starting point for future analyses to examine the ways in which these differences might colour our language use and our experiences. One such example of this is an examination of cognitive biases that can lead to micro-aggressions in the news, in workplace documents etc.
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Title: Same Storm, Different Boats: How the relationship between mental health and literacy skills in postsecondary students is affected by the COVID-19 pandemic

Authors: Anisa Yan, Esther Geva and Victor Kuperman

Research Context: In Canada, a large number of university and college students do not possess the required literacy skills needed to succeed in the workplace (Weingarten & Hicks, 2018). On top of that, school interruptions, school closures, and virtual instruction during the COVID-19 pandemic have contributed to increased learning losses and widened achievement gaps in a number of main study subjects (e.g., reading, mathematics; König & Frey, 2022). Poor literacy skills have been found to bidirectionally correlate with mental health symptoms, such that poor literacy skills predict later internalizing symptoms (Francis et al., 2019), and diagnosed internalizing disorders predict future academic achievement (Schrack et al., 2021). Although studies show that the COVID-19 pandemic has exacerbated postsecondary student depression, anxiety, and stress (e.g., Hamza et al., 2021), few studies to date have explored how these heightened mental health symptoms relate to pandemic-related decreases in student literacy. Research Question: This paper explores the relationship between postsecondary student mental health (i.e., anxiety and depression) and literacy assessed during the COVID-19 pandemic to identify risk-factors that may compound both pandemic-related setbacks in literacy and pandemic-exacerbated mental health symptoms.
Results: 189 postsecondary students completed online tests of reading comprehension, spelling, and vocabulary (in early 2021, about one year into the pandemic), as well as an online mental health battery examining anxiety, depression, and pandemic-related stress (completed in early 2022, about two years into the pandemic). Analyses conducted to date suggest that higher vocabulary scores were associated with lower levels of worry related to socio-economic consequences of the pandemic (e.g., "I am worried about grocery stores running out of food"; $r(187) = -.218$, $p < .01$). In addition, higher spelling scores were associated with a lower level of pandemic-related "checking behaviours" (e.g., seeking reassurance from friends or family about COVID-19; $r(187) = -.215$, $p < .01$). While relatively simpler constructs such as vocabulary and spelling were not associated with general anxiety and depression, reading comprehension, a more complex and multicomponent construct, correlated negatively with general anxiety ($r(187) = -.144$, $p < .05$). This relationship, however, was mediated by the participant's level of worry about the pandemic's socio-economic consequences (i.e., reading comprehension is only associated with pandemic-related anxiety symptoms). Notably, higher levels of socio-economic worries related to the pandemic were associated with higher depression scores ($r(187) = .315$, $p < .001$) and a lower socio-economic status ($r(187) = -.221$, $p < .01$). Emerging themes from follow-up qualitative interviews suggest that the effect of the pandemic on student mental health and literacy varies depending on individual feelings of isolation, motivation, and perceived educational support.
Conclusions: These preliminary results show that pandemic-related anxiety in postsecondary students is linked with performance on literacy tasks, yet this association may be mediated by external socio-economic and/or pre-existing mental health factors.
Significance: An integrated understanding of the pandemic's effect on post-secondary mental health and literacy skills has profound implications for the future of the "COVID Generation". More importantly, it can inform how postsecondary institutions will manage post-COVID mental health supports, curriculum accommodations, and academic expectations.

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Title: Effects of explicit instruction vs. implicit learning in artificial grammars

Authors: Shiloh Drake, Isabel Preligera and Melissa M Baese-Berk

Semitic languages, like Arabic and Hebrew, typically form words using abstract morphophonological templates that follow constrained phonotactic and phonological patterns (e.g., McCarthy, 1979, 1981). While the abstract templates are productive in natural languages, they are difficult for non-native speakers to learn (Albirini & Benmamoun, 2014). In artificial grammar tasks, templates mimicking those found in Semitic languages are also difficult to learn, regardless of whether participants already speak a language using templatic morphology (Drake, 2018). Many artificial grammar learning tasks also use implicit learning rather than explicit instruction when conducted (Drake, 2018; Ettlinger et al., 2016; Fedzechkina et al., 2016, among others) What is the difference between what is learned from implicit learning (as in artificial grammar tasks) and explicit instruction (as in L2 classrooms)?

This project investigates the effect of explicit instruction on the learning of abstract morphological templates using artificial grammar learning tasks. Participants were exposed to either an Englishlike suffixing grammar or an Arabiclike templatic grammar, and were either provided with instructions on how to form the plural, or were required to guess and adjust their hypotheses based on feedback during training. Participants in all four conditions were also asked to describe when they would use each of the two allomorphs they had learned. Sample stimuli are shown in the table below.

Root Consonants	Arabiclike Singular	Arabiclike Plural	Englishlike Singular	Englishlike Plural
B-K-D	bikidi	bakdu	bikid	bikiduk
K-F-D	kifadu	kfida	kifad	kifadaf

Data collection is ongoing, but preliminary analyses show that participants in both instruction conditions eventually settle on the knowledge that there is more than one way to form the plural, and that plurals end with either -k or -f (in the Englishlike grammar) or that there is a change in syllable structure (in the Arabiclike grammar). Participants in the Arabiclike grammar would use the allomorph with the initial consonant cluster more often than the allomorph with two closed syllables, potentially because the initial consonant cluster pattern was especially salient and/or novel to the monolingual English speaker participants. In the implicit instruction condition, participants required more training trials to settle on the two possible allomorphs, but were still able to narrow down their hypotheses to guesses that are appropriate for the grammar. Participants reported that they primarily used the final consonant and vowel to determine which allomorph to use in both instruction conditions and in both the Englishlike and the Arabiclike grammar, even though word formation occurred in very different ways. It is not expected that they would grasp the conditioning environments for the allomorphs as it is typologically unnatural in terms of phonological conditioning (manner of articulation of the second consonant), but they did use a strategy that is generally useful for determining which plural allomorph should be used in English. Participants' responses for what the pattern was in the explicit condition were more detailed and precise than in the implicit condition. These results indicate that explicit instruction allows participants to consider their knowledge of a new language in more detail more quickly, which then allows them to make generalizations to untrained forms sooner. However, it does not necessarily result in more accurate generalizations than knowledge gained from implicit learning. The results also suggest that artificial grammar studies that use implicit learning are ecologically valid.

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Title: Aging and Semantic Interference during Word Retrieval: A Syllable-judgment Modification of the Picture-word Interference Paradigm

Authors: Katarina Antolovic, Valerie Shafer and Loraine Obler

Theories of lexical retrieval diverge with respect to whether individuals actively inhibit non-target words to resolve interference during lexical selection (i.e., competition accounts; Levelt et al., 1999) or whether interference arises post-selection in an articulatory buffer (e.g., Mahon et al., 2007). Aging could offer insight into the mechanisms of lexical selection, as older adults are hypothesized to be more susceptible to interference from competing representations than younger adults due to age-related declines in inhibitory control (e.g., Hasher & Zacks, 1988). If selection involves inhibition of co-activated representations, older adults would theoretically experience interference while naming pictures in the context of related words. The picture-word interference (PWI) task has been widely adopted to examine lexical selection by comparing naming latencies to a target word when individuals are simultaneously presented with related or unrelated distractor words. Typically, category coordinates (e.g., dog and cat both belong to the category animals) generate interference (for a review, see Bürki et al., 2020), in line with competition accounts. Word associations (e.g., dog and bone) typically yield facilitation (e.g., Sailor et al., 2009), creating a dilemma for competition models in which co-activation between associated words should elicit interference. Aging may alter the pattern, resulting in interference from associations due to declining inhibitory control. We hypothesized that older adults would experience interference from both coordinates and associations while younger adults would exhibit the typical coordinate interference and associative facilitation.

To examine this, we asked 30 younger (mean age = 25.23) and 30 older adults (mean age = 69.50) to complete a modified PWI paradigm in which they made syllable judgments in place of overt naming. All participants were native English speakers who passed the Mini MoCA. Study procedures were conducted remotely. In the PWI task, participants indicated whether the word for a target image contained one or more syllables while ignoring a visually embedded distractor. Distractor words were either categorically related to the target word (e.g., target: bee, distractor: moth), associatively related (e.g., target: bee, distractor: honey) or unrelated (e.g., target: bee, distractor: knife). Participants also completed the Flanker task as a measure of non-linguistic interference control to examine the relationship between linguistic and non-linguistic interference control. Using a generalized linear mixed effects analysis, we found that older adults were slower overall, but interestingly, our results do not show an age-related susceptibility to interference from either categorically or associatively related words. Also, we did not replicate previous findings of interference from category coordinates in younger adults using our syllable judgment PWI task. There were small to moderate correlations between linguistic and non-linguistic task performance that were age-invariant, suggesting a tentative link between interference control across these two domains. We also examined whether education modulated task performance, as education impacts cognitive aging. There was an observed advantage with respect to educational attainment, with higher education yielding faster syllable judgments in the PWI task for both groups. We discuss how modifying the PWI task to obtain syllable judgments may have shifted the cognitive load associated with retrieval and reduced task sensitivity to detect interference effects. Moreover, we highlight the role of education in continually benefitting individuals across the lifespan.

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Title: Second and Third Language Effects on Chinese Compound Processing

Authors: Shiyu Li, Gonia Jarema and Gary Libben

Background: Recent studies have highlighted the extent to which the bilingual mental lexicon is an integrated system, characterized by interlingual translexical connections (e.g., Dijkstra & van Heuven, 2002; Pavlenko, 2009). The nature of interlingual connections has also been addressed in models of the trilingual mental lexicon (e.g., Benati & Schwieter, 2017; Tytus, 2017; see also Libben & Schwieter, 2019). Furthermore, research utilizing the compound constituent priming paradigm (Libben et al., 2017; Zhang et al., 2011) has suggested that the cross-language lexical links do not solely exist at the whole word level, but also extend into sublexical elements (i.e. the morphemes). In the present study, we conducted parallel experiments with native speakers of Chinese who were post-secondary students in either anglophone or francophone Canadian university contexts. This offered an opportunity to explore L2 to L1 as well as L3 to L1 morphological priming effects with a target language that is characterized by very high levels of compounding (Chinese) and two prime languages (English and French) that differ from Chinese in visual script and from each other in their levels of compounding.

Research Questions: Do L2 English or L3 French translation equivalents of L1 Chinese compound constituents affect Chinese compound recognition? To what extent are the EnglishChinese and French-Chinese priming effects comparable? How do they compare to baseline within-language priming effects (Pinyin to Chinese character priming)?

Methods & Data Analysis:. We recruited 32 Chinese native speakers who spoke English fluently as an L2, but had no or only limited knowledge of French for participation in a constituent priming experiment (Experiment 1). Targets were bimorphemic Chinese compounds, preceded by a constituent or an unrelated item translated into English. Linear mixed-effects models were fitted to response time data. Results indicated that participants recognized Chinese compounds as real words significantly faster when they were preceded by one of their constituents presented in L2 English than they were when preceded by an unrelated English word.

Experiment 2 included 33 Chinese-English-French trilingual speakers with high L3 French proficiency and a relatively lower level of L2 English proficiency. In this experiment, the same design and analysis procedures were employed as in Experiment 1, except that the primes were displayed in L3 French. A comparable constituent priming effect was generated by the French primes. Surprisingly, we failed to find any within-language priming effects when Pinyin served as primes for compounds in Chinese characters. (Experiment 3)

Conclusion: The L2 and L3 constituent priming effects on Chinese compound processing, which had similar patterns, provide evidence in favor of an integrated mental lexicon in bilinguals as well as trilinguals, in which the L2 and the L3 are both interconnected with L1 at the sublexical level. We propose that a compound processing approach may provide unique insights into the structure of the bilingual and trilingual mental lexicon. Using this approach, we were able to reveal sublexical representations and associations between L2 and L1, and also between L3 and L1. We discuss how the surprising finding of insignificant within-language Chinese priming outputs may reflect the fact that Chinese native speakers are called upon to recognize Pinyin written forms much less often than they are called upon to produce them. This possibility may have consequences for a more general consideration of how the priming paradigm may be sensitive to specific patterns of language use within and across languages.

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Title: The English Lexicon Imputation Project

Authors: Bryor Snefjella and Idan Blank

The psycholinguistic study of semantics is severely hindered by missing lexical data: between different datasets of lexical features (e.g. valence, concreteness) coverage of the lexicon is far from exhaustive. We present the largest set of lexical features ever created, covering more than 400 lexical features, generated via computational extrapolation. We call the resulting resource the English Lexicon Imputation Project (E-LIP).

Like previous attempts to replace empirical measurement of lexical features with statis- tical estimation, constructing E-LIP comprises two steps: (1) use the empirically measured features available for a subset of the lexicon to train a model that predicts those features fromword embeddings (i.e. black-box semantic representations derived from corpus co-occurrence counts); and (2) use this model to predict these features for words without empirical measurements, based on those words' embeddings. However, unlike all previous lexical feature extrapolation studies, E-LIP is grounded in the statistical theory of missing data imputation, as recommended by Snefjella and Blank (2020). It uses a method known as multiple imputation, whose key insights informing our resource include: (1) Missing values should be imputed with random draws from a Bayesian posterior distribution conditioned on the observed data; (2) Each missing value should be imputed $m > 1$ times, with a large m when more data is missing; (3) Downstream analyses using the resource should be repeated over the $m > 1$ imputed datasets, and the results pooled, to incorporate the additional uncertainty that missing data implies; (4) The imputation model should be conditioned on any dependent variables of any subsequent analyses (e.g., lexical decision RTs); and (5) The imputation model must make compatible assumptions with any later analyses. Our extrapolations are unique in fulfilling these 5 criteria.

To meet these criteria, we use a deep neural network multiple imputation method, the multiple imputation importance weighted autoencoder (MI-WAE Mattei and Frellsen, 2019). This technique provides an efficient and flexible method for performing multiple imputation in high dimensions, as required in this context (given the high dimensionality of word embeddings). New imputations can be easily generated from the trained model, allowing easy fulfillment of criteria (1)-(3). Unlike all previous attempts to impute missing lexical

features, we condition this model not only on pretrained word embeddings but, critically, on all extant, partially observed empirical lexical features, and a wide array of behavioral measurements in a variety of language processing tasks, including lexical decision, semantic decision, recognition memory, self-paced reading, and eye-tracking, as required by criterion (4). Imputed lexical features include every semantic, orthographic, and single-word phonological feature we could locate open-source data for in the psycholinguistics literature. The flexibility of MI-WAE allows for E-LIP to be used in analyses that test for non-linearities and interactions, i.e. there is minimal risk of violation of criterion (5).

We argue that the use of imputed lexical features from E-LIP should replace the de-facto methodological default of complete case analyses (analyzing only words with existing complete lexical features) in the study of the mental lexicon. This widespread but under-acknowledged practice yields biased and low-powered analyses (Rubin, 1976, 2004) when data is systematically missing, which is the case for many lexical features (Snefjella & Blank, 2020). We present simulation evidence of the model's effectiveness and examples where using the E-LIP resource leads to qualitatively different conclusions than complete case analysis.

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Title: Gender and case in Russian nouns denoting professions
Authors: Varvara Magomedova and Natalia Slioussar

Russian language has three genders (M, F, N). The gender of the noun cannot be unambiguously determined from its inflectional affixes, but becomes evident from agreeing adjectives, participles and verbs. Nouns are inflected for two numbers and six cases (nom, gen, dat, acc, ins, loc).

We analyzed a group of nouns denoting professions. Historically, they were masculine. Now they can also be used with F agreement, but only nominative forms are regarded as normative: e.g. etot/ eta vrač 'thisM/F doctor' (Graudina et al. 1976; Zaliznjak 2002; Sitchinava 2011). Previous studies looked only at nominative forms (e.g. Panov 1968; Novikov & Priestly 1999; Corbett 2006), while we conducted a web-as-a-corpus study and three experiments focusing on oblique cases.

Our corpus study showed that oblique forms with F agreement occur naturally, but are infrequent. Experiment 1 was a grammaticality judgment study on a 1 to 5 scale (N=53). We created 15 sets of stimulus sentences with 15 nouns in five oblique cases, as in (1). There were no significant differences between different cases — as Table 2 shows, they were all judged as marginal.[1] In Experiment 2 (N=35), we took stimuli from Experiment 1. Rather than showing participants one sentence from each set, we presented all sentences from one set at once (in a random order) and asked participants to range them from the worst to the best using the 1 to 5 scale. Loc was significantly worse than all other cases (see Table 2).

(1) Ja uznal o svoem diagnoze ot našej vrača.
I learned about self's diagnosis from ourF.GEN.SG doctorGEN.SG 'I learned about my diagnosis from our doctor'.

Table 2. Average ratings of sentences in Experiments 1 and 2.

	gen	dat	acc	ins	loc
Exp. 1	2.0	2.0	1.9	2.0	1.8
Exp. 2	3.0	2.9	3.4	4.0	1.4

In a self-paced reading Experiment 3 (N=68), stimuli like (2) were used. On the target noun, the differences in the Gen, Dat and Ins groups reached significance. On the N+1 word, every group had significant differences (i.e. both structural Nom and Acc and other oblique cases). In the N+2 and N+3 regions, the difference between the two conditions was significant only for Loc.

(2) Petr uznal ot opytnogo / opytnoj vrača o svoem diagnoze.
Peter learned from experiencedM.GEN.SG/F.GEN.SG doctorGEN.SG about self's diagnosis.
'Peter learned about his diagnosis from an experienced doctor'.

Firstly, this is a unique example when the properties of the form influence the properties of the lexeme: these nouns' case predetermines how good they are in a particular gender. Secondly, the fact that all oblique forms are regarded as marginal points to a deep connection between gender and inflectional classes. This is hard to explain in many morphological theories, e.g. in Distributed Morphology (Kramer 2015). Some optimality-theoretic models have better chances (Rice 2005; Doleschal 2000), but have never been applied to such data. Apparently, Nom forms are acceptable because at least some F nouns have a zero inflection in Nom.Sg. But no F noun has -a in Gen etc., and this becomes an unsurmountable obstacle. Many F nouns have -e in Loc, but not the ones with a zero inflection in the Nom. As a result, rather than saving Loc, this syncretism makes it especially bad. This is interesting both for theoretical morphology and for psycholinguistics, because previously, only facilitatory effects of syncretism were reported.

[1] Ordinal logistic and linear regressions with mixed effects (intercepts) by participant and by item were used for the statistical analysis.

Title: Grasping the shadow of metaphor: A computational study on the ease of understanding metaphor

Authors: Parastoo Harati, Rachel Mustaklem and Chris Westbury

Despite the complex nature of metaphors, they pose no difficulty for language users to comprehend in comparison to literal language and metaphorical words constitute around twenty percent of the words in common parlance (Shutova, 2010). However, despite their ubiquity, a lot is still unknown about the ease of understanding (a.k.a. comprehensibility) of metaphors.

Computational studies are far behind in research on human judgment of ease of understanding in comparison to psycholinguistic studies. We previously enhanced a computational model of metaphor comprehension by Kintsch (2000) and modelled the human judgment measure of goodness (Harati et al., 2021). In this study, we use the same model to identify the same model's performance on extrapolating measures of ease of understanding.

We selected 129 metaphors from our previously developed battery of novel nominal metaphors (i.e., "X is a Y) in which the metaphors are rated based on ease of understanding using best/worst scaling. Participants were displayed with a single metaphor on the screen from which the source word (Y) was missing and they were required to make a choice between the two words that they believed would result in the best metaphor. A response was considered 'correct' for the purpose of our work when participants chose the metaphor that our model predicted would be the easiest to understand.

We used linear mixed-effects modelling to analyse the data. We found that participants had significantly faster responses when asked to choose the metaphor when the metaphor had a higher ease-of-understanding estimate. We concluded that our model can reliably extrapolate human judgments of ease of understanding.

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Title: Probing the paradigmatic enhancement of German interfixes with linear discriminative learning

Authors: Motoki Saito and Harald Baayen

According to the paradigmatic signal enhancement hypothesis (Kuperman, Pluymaekers, Ernestus, & Baayen, 2007), exponents that have higher probability within their paradigm are phonetically enhanced. Kuperman et al. (2007) proposed this hypothesis on the basis of the acoustic durations of interfixes in Dutch compounds, but other studies have provided fur- ther evidence in other morphological domains (Cohen, 2014; Tomaschek, Tucker, Ramscar, & Baayen, 2021). In the present study, we examine the interfixes in German compounds, and investigate whether paradigmatic enhancement can be, at least in part, understood within the framework of the Discriminative Lexicon model (DLM) (Baayen, Chuang, Shafaei-Bajestan, & Blevins, 2019), a computational theory of the mental lexicon. Whereas the paradigmatic enhancement hypothesis assumes that paradigms structure the mental lexicon, and that within paradigms, word forms somehow gang up to favor forms with higher paradigmatically condi- tioned probabilities, this hypothesis remains agnostic as to how and why paradigmatic enhance- ment takes place. This study takes inspiration from the recent findings of Gahl and Baayen (2022), who reported for English homophones such as thyme and time (cf. Gahl, 2008) that the amount of support that according to the DLM a word form receives from its meaning (repre- sented using distributional semantics) is a strong co-determinant of it spoken word duration, such that greater semantic support predicts longer spoken word durations. The hypothesis that phonetic duration is positively correlated with the amount of semantic support receives further support from an electromagnetic articulography (EMA) study of German inflected words that we carried out. This EMA study indicated that a greater semantic support predicted more low- ered, and hence likely more distinct, articulation for /a/ vowels. The present study explores the possibility that German interfixes are phonetically enhanced, and realized with longer du- rations, thanks to more semantic support as gauged with the DLM.

To this end, we first collected all the compound words in German from the CELEX database For these compound words, paradigmatic probability and semantic support for the interfix were somewhat correlated (τ_b = 0.073, $p < 0.0001$). (Baayen, Piepenbrock, & Gulikers, 1995). Subsequently, for those compound words that are attested in the Karl Eberhards Corpus of spontaneously spoken southern German (KEC: Arnold & Tomaschek, 2016), interfix duration was modelled as a function of semantic support for interfix, paradigmatic probability, as well as other covariates such as compound frequency, by-segment amount of information, paradig- matic entropy, speech rate, presence/absence of a schwa in the target interfix, and speaker. The regression model suggested that semantic support and paradigmatic probability were both asso- ciated with longer interfix duration. A further analysis was carried out with the vertical tongue tip positions during the articulation of the interfixes as response variable. Although this specific dataset was quite small (583 interfix tokens, 25 word tokens, and 10 word types), articulatory enhancement (with higher tongue positions for the -n and -s, interfixes) was observed for larger values of both paradigmatic probability and semantic support for the interfix. Interestingly, the reduction in AIC obtained by adding semantic support was greater than the reduction in AIC resulting from including paradigmatic probability, for both acoustic duration (ΔAIC = 3.570) and for vertical tongue tip positions (ΔAIC = 58.839). Our results clarify that the semantic support that an interfix receives is a factor that is at least as important as paradigmatic probability. A question awaiting further research is how the effect of paradigmatic probability that is not captured by semantic support can be understood within the theory of the discriminative lexicon.

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Title: Reading proficiency modulates word length, frequency, and word predictability effects in reading English as L1 and L2

Authors: Daniil Gnetov, Sascha Schroeder and Victor Kuperman

Reading proficiency in one's first language is a robust predictor of reading behaviour as reflected in the patterns of eye movements [1]. There is also evidence to suggest that individual reading proficiency modulates the reader's sensitivity to classical "benchmark" effect of eye-movements during reading: word length [2], word frequency [3, 4, 5], and word predictability [5]. However, the nature of those interactions in second language reading is unknown due to only a handful of studies done on this topic. In this study we investigate the role of reading proficiency in modulating the benchmark effects of eye-movements during reading in English as a first and second language.

We used eye-movement data and a test battery of component skills of English from the Multilingual Eye-Movement COrpus (MECO L2, www.meco-read.com). The data are collected from over 540 participants (university students, mostly advanced L2 readers of English) in 12 countries reading short expository texts in English as L1 or L2. Word frequency and predictability (a computational measure of word's similarity to previous context) were computed using fastText vector models pre-trained on Wikipedia corpus. Participants' reading proficiency was estimated as a composite of z-scores from the battery of tests tapping into component skills of reading (vocabulary size, spelling, decoding, sight word efficiency, lexical decision).

The results of the word-level analysis of eye movements point to the strong interactions of proficiency level with all three benchmark effects. More proficient readers are less sensitive to word length, frequency and predictability effects.

Moreover, word predictability effects emerge late in the eye-movement record, while word length and frequency effects are early. The individual proficiency score representing component skills of English reading proved to be more influential than the specific L1 background of participants.

This is the first study to provide quantitative estimates of the modulating role that individual proficiency plays on the benchmark effects for reading in English, across a wide range of language backgrounds, skill levels, and a large-scale sample of participants.

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Title: Assessing the Potential Long-term Effects of Otitis Media on Language Skills in Young Adults
Authors: Olga Prudnikova, Robin MacDonald and William Owen

Previous research has demonstrated that recurrent otitis media (ROM – ear infections) in childhood may decrease the quality of or acquisition of phonological representations (i.e., mental representations for spoken words) in children and that these deficits may persist into adulthood (Carroll & Breadmore, 2018). High quality phonological representations and categorization is critical for the identification and discrimination of sounds, as well as essential for understanding the relationship between printed words and sounds (Carroll & Breadmore, 2018). Children with a history of otitis media, in comparison to a healthy control group, performed less accurately on speech perception tests with stimuli of varying degrees of phonetic contrast, presumably due to the deficits in phonological quality or processing (Mody et al., 1999).

The purpose of our study is to investigate the effects of ROM in early childhood on phonological language skills in an adult population. We utilized Owen and Borowsky's (2003) methodology for exploring the nature of the connection between orthographic (i.e., mental representations for printed words) and phonological representations in healthy adults. The two- alternative forced choice methodology involved presenting a "context" stimulus (e.g., saw: "cap") simultaneously with a target stimulus that was congruent (e.g., heard: /cæp/ and then presented with the response choices: "cap"/"map"), incongruent (e.g., heard /mæp/ and then presented with the response choices: "cap"/"map"), or irrelevant (e.g., heard /mæp/ and then presented with the response choices: "map"/"rap"). In their study, they showed evidence for direct faciliatory connections from orthographic to phonological lexical representations, and equal facilitation and inhibition of phonology on orthographic processing.

In this study, we examined whether the Owen and Borowsky methodology would be diagnostic of those with histories of ROM in childhood. More specifically, the group of young adults with normal hearing was hypothesized to show a facilitation pattern (consistent information helps more than inconsistent information hurts accuracy) of orthography to phonology, similar to the results demonstrated in the original study. The group of young adults with a childhood history of ROM was predicted to show equal facilitation and inhibition to and from orthographic representations and phonological representations. If these predictions hold, it would indicate: (1) the Owen and Borowsky method is a sensitive tool to detect phonological impairments, and (2) that ROM can have subtle and long-lasting impacts on language skill development.

Preliminary results indicate that we were able to replicate a pattern of facilitation dominance from orthography to phonology and that there were individual differences between the two groups. We discuss the implications of the results on consideration of future research regarding the impact of ROM on phonological representations and processing.

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Title: A time-to-event analysis of pronunciation durations in the word naming task in Mandarin Chinese

Author: Ching-Chu Sun and Peter Hendrix

Psycholinguistic studies often record unidimensional response variables that are thought to reflect lexical processing, such as response times or pronunciation durations. Most commonly, these response variables are analyzed through a regression analysis of the mean of the response variable. An analysis of the mean provides valuable information about the lexical-distributional variables that influence the total time it takes to respond to a stimulus or pronounce a word. What it does not do, however, is provide insight into the time course of lexical processing.

Time-to-event analysis allows for the investigation of predictor effects over time, even when the response variable is unidimensional in nature (i.e., only measures the endpoint of a process). Specifically, time-to-event analysis models the time at which an event of interest occurs. Recently, we applied time-to-event analysis to response times in the visual and auditory lexical decision tasks to gain insight into the time course of lexical processing in language comprehension (Hendrix & Sun 2019, 2020, 2021). Here, we further explore the potential of time-to-event analysis for the analysis of psycholinguistic data through a time-to-event analysis of pronunciation durations in the word naming task. Specifically, we analyze the pronunciation durations for 3,000 two-character words in a word naming experiment in Mandarin Chinese.

The event of interest in the time-to-event analysis is the end of a pronunciation. Following Hendrix and Sun (2019, 2020, 2021), we adopted the piece-wise exponential additive mixed model (PAMM; Bender et al., 2018) to conduct the time-to-event analysis. For the current data set, the PAMM models the instantaneous probability of the end of a pronunciation at each point in time, provided that the pronunciation did not end previously. Unlike traditional models for time-to-event analysis, the PAMM is able to model non-linear predictor effects that developed in a non-linear manner over time. As such, it provides rich information into the time course of potentially non-linear predictor effects on pronunciation durations.

Consistent with the results reported in previous studies, the PAMM analysis revealed facilitatory effects of word frequency (cf. Gahl, 2008; Wiener et al., 2012) and phonological neighborhood density (cf. Gahl et al., 2012). Interestingly, the PAMM analysis revealed that the effects of both word frequency and phonological neighborhood density were most prominent or exclusively present during the early stages of the analysis window. Word frequency and phonological neighborhood density thus primarily influence the instantaneous probability of the end of a pronunciation relatively soon after pronunciation onset. This insight could not have been obtained through a more traditional regression analysis of the mean.

The effects of word frequency and phonological nature were quantitatively different, but qualitatively similar at different points in time. The hitherto unreported effect of a third predictor, homophone count, however, was qualitatively different at different points in time. An early inhibitory effect of homophone count was followed by a later facilitatory effect. The effect of homophone count suggests that the homophone count measure taps into at least two distinct cognitive mechanisms that influence the instantaneous probability of the end of a pronunciation at different points in time.

The early inhibitory and late facilitatory effects of homophone count would entirely or partially have cancelled each other out in an analysis of the mean, masking either one or both of the effects. Unlike more traditional analysis techniques, the PAMM thus is able to not only provide information about the temporal dynamics of predictor effects, but to also uncover effects that might otherwise remain hidden in the data.

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Title: The Canadian Bilingual Naming Task: A novel task to assess picture naming in French-English bilinguals

Authors: Mikayla Trudeau-Meisner, Christine Sheppard, Laura Monetta and Vanessa Taler

Introduction: Assessment of language function is critical in the clinical diagnosis of disorders including mild cognitive impairment (MCI; Adlam et al., 2006), as well as Alzheimer's disease and related disorders (McKenna & Warrington, 1980). One of the most frequently-used language tests is picture naming, particularly the Boston Naming Test (BNT; Kaplan et al., 1983). However, studies show that cognitively healthy French-speakers and English-French bilinguals score lower on the BNT than their English-speaking counterparts (Sheppard et al., 2016). This suggests that the BNT is an inappropriate tool for French-speakers or English-French bilinguals.

Objectives: The aim of the present study was to assess the performance of English monolingual, French monolingual, and English-French bilingual older adults on the Canadian Bilingual Naming Task (CBNT), a novel, 30-item picture naming task that has been designed specifically for the assessment of language function in English-French bilinguals.

Methods: We collected data from English monolingual (n=38), French monolingual (n=28), and English-French bilingual (n=28) cognitively healthy adults aged 65+ to compare their performance on the CBNT and BNT. Approximately 85% of the bilingual participants identified French as their dominant language. All monolingual participants completed the tasks in their native language, while bilingual participants completed the task three times: in English, French, and an either-language condition where they could switch freely between English and French.

Results: Our results indicated no significant differences between English monolingual, French monolingual, and bilingual highest CBNT scores. The English monolinguals had significantly higher BNT scores than the bilingual and French monolingual groups, which is consistent with previous findings. For both naming tasks, the bilingual participants' mean scores were highest in the either-language condition, although there was a subset of the sample (36%) who scored highest in their dominant language on the CBNT. We continue to investigate how dominant language impacts language condition performance and either-language condition responses.

Conclusion: This study presents the BNT as an inappropriate measure of bilingual and French naming ability. The CBNT can be employed instead of the BNT to assess language function in English monolingual, French monolingual, and English-French bilingual older adults. Lexical competition between languages may explain why a subset of the bilingual participants scored lower in the either-language condition than in their dominant language.

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Platform Session 1.2

Title: A Tale of Two Lexica: Investigating Computational Pressures on Word Representation with Deep Neural Networks

Authors: Enes Avcu, Michael Hwang, Kevin Brown and David Gow

Words play a pivotal role in almost every aspect of language processing. The dual-stream model of spoken language processing (Hickok & Poeppel, 2007) suggests that processing is organized broadly into parallel dorsal and ventral processing streams concerned with dissociable aspects of motor and conceptual-semantic processing. Drawing on converging evidence from pathology, neuroimaging, behavioral research, and histology, Gow (2012) proposes that each pathway has its own lexicon or lexical interface area, which mediates mappings between acoustic-phonetic representation and stream-specific processing. In the dorsal processing stream, the supramarginal gyrus and inferior parietal lobe mediate the mapping between sound and word-level articulatory representation. In the ventral processing stream, the posterior middle temporal gyrus mediates the mapping between sound and semantic/syntactic representation. We hypothesize that this separation arose because of fundamental differences in the computational requirements of these mappings. The mapping between sound and articulation, though complex, is largely systematic and temporally continuous. In contrast, the mapping between sound and syntactic/semantic information, though partially systematic at the level of productive morphology, is largely arbitrary and dependent on identifying larger temporal units.

To test this hypothesis, we created two LSTM networks and trained them independently on the same set of auditory word tokens. A dorsal model was trained to identify individual spoken words, while a ventral model was trained to map them onto overlapping sets of word context frames drawn from a corpus of meaningful text as a surrogate representation of semantic content. All words had unique output representations in each network informed by overlap at the level of phoneme sequences and framesets in the two respective models. After training both models to asymptote, we extracted patterns of network activation from the hidden layer of each network and tested how well the features extracted from the dorsal network supported the classification of input based on articulatory versus semantic or syntactic properties. We predict that: (i) Features from dorsal LSTM models trained on wordform identification should have an advantage for categorization related to articulation but not semantic/syntactic categorization,
and (ii) Features from ventral LSTMs trained on sentential context frames should have an advantage for semantic/syntactic categorization but not categorization related to articulation.

Our results demonstrate that training the same set of networks on differently structured lexical representations produced different featural representations at the hidden layer of each model and that these emergent representations supported different patterns of performance on secondary tasks. Despite being trained on output vectors that were not structured to reflect the phonological structure, the dorsal model discovered a feature space that supported the classification of word-initial phonemes by articulatory classes. In the same vein, the ventral model discovered a feature set that supported grammatical categorization without explicitly having been trained on grammatical categories. The finding that the ventral model outperformed the dorsal model on grammatical category classification is not surprising, but it again demonstrates that task demands shape feature spaces that are better suited for different types of generalization.

These results suggest that the development of parallel lexica in the dorsal and ventral pathways arose from computational pressures for optimizing the primary mapping functions that support lexically organized processes in the dorsal and ventral processing streams.

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Title: Rank frequency effects in lexical processing are predicted by parallel processing models and do not provide evidence for serial search

Author: Vsevolod Kapatsinski

Murray and Forster (2004) showed that rank frequency is a better linear predictor of lexical decision times than log frequency (replicated in Figure 1 based on SUBTLEX frequencies of verbs correlated with lexical decision times from Balota et al., 2007). Murray and Forster argued that this finding contradicts parallel models of processing, and supports Forster's (1976) serial search model of word recognition. Specifically, the rank frequency of a word is the number of steps it would take to find the word by going down a list of words ordered in inverse frequency order. This idea has recently risen in prominence within the generative psycholinguistics community because Yang (2016, 2018) used it to derive a theory of productivity: according to Yang, a rule is productive if it wouldn't take too long to serially search the list of exceptions to the rule.

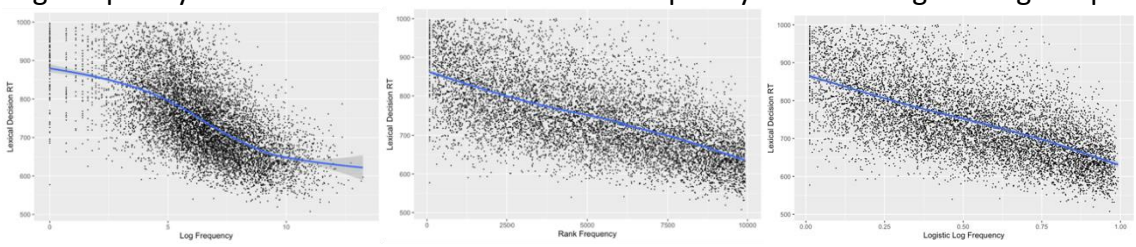
In this talk, I show that Murray and Forster's results do not imply serial search, and are fully consistent with parallel processing models of word recognition (Morton, 1969; Plaut & Booth, 2000). Although this has also been argued in previous work (Adelman & Brown, 2008), that work argued that the rank frequency effect arises because the true predictor of decision times is contextual diversity (the number of distinct contexts a word occurs). The present paper argument does not require reference to predictors other than frequency, showing that the rank frequency effect does not require serial search even if frequency is indeed the relevant predictor.

Error-driven learning models that learn connections from sublexical cues to a word suggest that the activation reaching a word node would be roughly proportional to its log frequency (Baayen, 2010; Olejarczuk et al., 2018). However, this does not mean that lexical decision times should be a linear function of this activation. First, parallel models make categorical decisions (such as lexical decision) by activating nodes with logistic activation functions (see Plaut & Booth, 2000, for lexical decision specifically). These nodes sum inputs and transform the sum through an S-shaped function bounded between 0 and 1, as probabilities must lie within this interval. Second, rank frequency turns out to be an S-shaped function of log frequency (Figure 1). Therefore, Murray and Forster's results are consistent with the lexical decision time tracking the output activation of a decision node whose input activation is proportional to the log frequency of the word (i.e., a logistic transformation of log frequency, as shown in the right panel of Figure 1, performs just as well a rank frequency, shown in the middle panel).

In conclusion, the superiority of rank frequency over log frequency in predicting lexical decision times is fully consistent with standard assumptions about how processing and learning work in parallel models. It provides no evidence for serial search.

Figure 1. Lexical decision times for verbs from the English Lexicon Project (Balota et al., 2007) as a function of log, rank and logistic log word frequency.

Log Frequency Rank Frequency Logistic Log Frequency



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Title: The Principal Components of Semantics: An Update

Authors: Chris Westbury, Lee Wurm and Kris Anderson

Hollis & Westbury (2016) undertook an analysis of the principal components (PCs) of semantics in a word-embedding matrix. Here we update and extend that analysis, by characterizing the PCs more rigorously and thoroughly; by using much bigger matrices; and by cross-validating our analysis on two different matrices constructed with independent datasets of over a billion words.

Hollis & Westbury (2016) suggested that PC1 was mainly associated with word frequency, reporting a non-cross-validated correlation of 0.42 between the PC1 values and logged frequency, accounting for about 17.7% of the variance in PC1. We failed to replicate this result with our larger word set, finding that frequency accounted for only 1.4% of the variance on PC1 values. We demonstrate that a well-defined measure of personal relevance (defined algorithmically, without any need for human judgment) can account for over 50% of the variance in PC1 values. We also show that closely-related measures focused specifically on abstract or concrete words are strong and distinct predictors of variance in PCs 2 through 4. These results are very stable when computed across word-embedding matrices from distinct corpora (PC values are correlated > 0.90 over > 45,000 words).

We will discuss the implications of these results for our understanding of lexical semantics.

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Platform Session 1.3

Title: The impact of walking and visual distraction on lexicality judgements in single and multitask settings

Authors: Naomi Vingron, Nancy Azevedo, Gonia Jarema, Joyce Fung, Gianluca Sorrento, Sarah Lee, Roya Khalili, Anouk Lamontagne, Ruthann Atchley, Paul Atchley, Juhani Järvikivi, Debra Titone, Gary Libben and Eva Kehayia

Much of the existing work on dual tasking has focused on settings such as traffic safety, where concurrently performed cognitive tasks may pose a detriment to walking. While such investigations are crucial to understanding human functioning in our modern world, the effects of walking on concurrent linguistic and visual tasks are understudied. The present study addresses this gap targeting initially healthy young adults.

Our current research questions are twofold: (1) Are speed and/or accuracy of lexical decisions affected in a dual-task condition compared to a single-task condition? (2) Is there an effect of additional visual distraction on lexical decisions in single- and dual- task conditions? To address these questions, we created an immersive virtual urban environment using custom-made virtual reality technologies and a self-paced treadmill synchronized to visual projections.

Participants are asked to complete two experiments: a single task session, involving a simple lexical decision task (LDT) performed while seated facing the static virtual scene, and a dual-task session, involving the same lexical decision task performed while walking on a self-paced treadmill through the virtual environment. Additionally, across both sessions, some trials include visual distractors in the form of flashing red squares appearing simultaneously with the lexical item. The LDT comprised 320 trials including words, pseudowords and nonwords. The three stimuli types were matched for length, words and pseudowords were matched for number of lexical neighbours. Word stimuli had a moderate frequency of use in English (mean ~10 occurrences/million). In each trial the stimulus remained on the screen for 4000ms or until a response was given. The inter-stimulus interval (ISI) was set at 500ms.

To date, we have tested 22 English- dominant participants (mean age: 22.9 years; range 18-30). Using linear and generalized linear mixed effects models, we examined the effects of the task conditions on correct response times and error rates. As found in previous studies, responses in the single-task were slowest and error rates were highest for pseudowords (RT: M = 802ms; SD = 280ms/ ER: M = 0.08; SD = 0.27) compared to words (RT: M = 669ms; SD = 166ms/ ER: M = 0.04; SD = 0.19) and nonwords (RT: M = 623ms; SD = 145ms/ ER: M = 0.00; SD = 0.07).

Furthermore, participants responded less accurately when lexical stimuli appeared along with a visual distractor (distractor present: M = 0.08; SD = 0.27/ distractor absent: M = 0.03; SD = 0.18). We then examined how these effects are modulated by the addition of walking. As our preliminary results suggest, the expected pattern of lexicality effects remains unchanged in the dual-task condition. While in the single-task condition error rates on visual distractor trials were comparable for words and pseudowords, the addition of walking appears to modulate this effect, increasing error rates for words (M = 0.08; SD = 0.28) to the level of pseudowords (M = 0.10; SD= 0.30).

To sum up, during single tasking, the magnitude of the pseudo- vs word effect is increased with the presence of a distractor, while the overall pattern remains the same. During dual-tasking, both the magnitude and pattern of the pseudo- vs. word effect change in that words become harder to process (resulting in higher error rate). These preliminary results suggest that while young adults do well on this task overall, the addition of walking may affect LDT performance, particularly in the presence of visual distractors. We see evidence of the system being increasingly taxed by the presence of visual distractors and concurrent walking. In the future, we will collect additional data, including from older adults, which will allow us to identify where cognitive resource management during multitasking begins to break down.

Title: Examining the Relationship Between Implicit Prosody and Visual Word Recognition Using ERPs

Authors: Stephanie Wolfe, Srishti Nayak, Cyrille Magne

Prosody--which is the stress, intonation, and timing of language--is an important component of oral communication. It conveys emotion, sarcasm, and emphasis, and aids in comprehension of language. Prosody is implicated in many linguistic processes including language acquisition by infants (e.g., Jusczyk, 1999), as well as phonological, lexical, and syntactic processing in children and adults (Gordon et al., 2015). The Implicit Prosody Hypothesis (IPH) (Fodor, 1998, 2002), proposes that readers produce an internal representation of prosody during silent reading. Previous work examining the IPH has been primarily concerned with phrase level processes, while word level processes have been largely unstudied. Eye tracking studies have found longer reading times for words with unexpected stress patterns which may indicate lexical access is affected by word-level prosody (e.g., Breen & Clifton, 2011). In the current study, we sought to investigate whether prosody is a fundamental aspect of lexical representations by examining the neuropsychological underpinnings of implicit prosody during word reading.

Electroencephalographic (EEG) recordings were obtained while 24 adult participants silently read one hundred sequences of five bisyllabic words in two main conditions. In condition one, the first four words of lists were stressed on the first syllable (i.e. trochaic). In condition two, the first four words were stressed on the second syllable (i.e. iambic). The fifth word in each condition was either rhythmically congruent or incongruent with the previous four words. Event related potentials (ERPs) were derived from the EEG data to examine time-locked responses to the stimuli. Differences in amplitudes, latencies (timing relative to stimulus onset), and scalp distributions of ERPs were examined to understand aspects of sensory and cognitive processing that cannot be assessed through behavioral measures alone. Results showed that in both trochaic and iambic conditions, rhythmically incongruent target words elicited statistically significantly larger amplitudes in centro-frontal scalp locations when compared to rhythmically congruent target words. Unexpected trochaic words showed increased negativities from 362 - 882 ms post stimulus, while unexpected iambic words elicited increased negativities from 214 - 440 ms post stimulus. Furthermore, larger differences in amplitude were observed for unexpected trochaic words than for unexpected iambic words. Ongoing analyses will examine the similarities and differences between implicit and overt prosody by statistically comparing the ERPs found in this study, to data acquired from an auditory version of the same paradigm (Magne et al., 2016). The brain responses observed in the current study suggest prosodic features of words are accessed during silent reading, lending support to the IPH. Furthermore, they are consistent in latency and scalp distribution with the N400 response. According to this interpretation, they reflect a series of processes working together to bind information extracted from the stimulus (e.g., orthographic and phonological features) with representations in the lexicon to create meaning. This would suggest prosodic features are part of the lexical representation of words that impact lexical retrieval processes, and thus should be considered in models of reading.

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Title: Processing Speed During Word Learning is Related to Vocabulary Size

Authors: Katherine Snelling and Stanka Fitneva

The present study examined the mechanisms used in adult word learning, specifically the relationships between processing speed, word learning, and vocabulary size. Children with larger vocabularies tend to process words more quickly[1–7]. Processing is also related to vocabulary size when words are novel[8]. Unlike familiar words, speakers cannot identify the referents of novel words using prior knowledge. Instead, they map novel words to referents using knowledge about the labels of competitors [9,10] or based on co-occurrences over time[11]. Much less is known about word learning in adults than in children. Is the speed of adults' orientation to novel referents related to learning those referents and to overall vocabulary size?

Multiple mechanisms drive word learning[12]. The ability to disambiguate – mapping novel words to novel referents and not known referents – emerges early in development and may continue to contribute to adult word-learning[8,10,13]. Processing quickly may be necessary to interpret and learn words[14]. During word learning, individuals may develop expectations that subsequent experiences disconfirm. This study thus examined processing when evidence was consistent and inconsistent with expectations. We predicted that adult learners who oriented more quickly to the referent of words would learn more words and have larger vocabularies, regardless of whether the word-referent pairs were consistent or inconsistent with prior experience.

This study tested these hypotheses using a cross-situational word learning (CSWL) task.

Before CSWL, participants (n = 65) saw one-to-one word object pairs, which were either maintained (consistent) or not (inconsistent) in the CSWL phase. In the CSWL phase, participants saw two referents and heard two words. Participants could learn the true referents using regularity between trials, and disambiguation, as each trial contained a consistent word first and an inconsistent word second. Processing was measured using the speed to look at the referent of consistent and inconsistent words. After a forced-choice test to assess learning, participants completed productive and receptive vocabulary tasks.

During the first CSWL block, participants looked more at the referent of the inconsistent word than would be expected by chance. As they had never seen this word and object co-occur, this is evidence that adults used the consistent word to disambiguate the meaning of the inconsistent word.

As expected, the speed of orienting to the referent, both when words were consistent and inconsistent with expectations, was related to word learning. Furthermore, faster orientation following inconsistent but not consistent words was associated with larger productive and receptive vocabulary size.

This research shows that processing speed is directly related to vocabulary and word learning, without prior experience contributing to the relationship. The relationship between processing speed and vocabulary size contributes to our understanding of the factors that may be involved in ongoing vocabulary growth during adulthood. Understanding the cognitive abilities that support lexical development during adulthood is necessary as adults must develop specialized knowledge to succeed in many areas of their lives.

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Poster Session 1.2

Title: The effects of creativity and difficulty on analogical reasoning in L1 and L2

Authors: Miki Ikuta and Koji Miwa

This study investigates first- (L1) and second-language (L2) analogical reasoning processes. When people learn something new, retrieving prior knowledge and transferring it to a new domain is a fundamental cognitive process (Gentner & Maravilla, 2018). Wakebe et al. (2015) investigated whether the use of L2 has an inhibitory effect on analogical reasoning. In their study, Japanese learners of English were assigned to read passages to solve a target anagogical problem either in Japanese (L1) or English (L2). Their results showed that L1 analog group performed better than L2 analog group in the test phase. Their study was well-designed, yet some linguistic predictors such as frequency and problem difficulty were not sufficiently considered. To better understand the mechanism underlying L2 analogical reasoning, we investigate the language effect on analogical problem-solving by using a simpler problem form which is called four-term A:B::C:D verbal analogy (e.g.; bee:hive::money:bank).

To study analogical processing in both languages and L2 inhibitory effect on analogical reasoning, we first conducted a rating experiment to measure the difficulty and creativity of the problems. We prepared 100 analogical reasoning problems in Japanese (L1) and English (L2). The participants were 46 Japanese learners of English. The participants' accuracy (correct or incorrect) and reading time of the problems were analyzed with (generalized) linear mixed-effects modeling. The preliminary result of the L2 analysis revealed that the difficulty score significantly predicts the accuracy and reading time of problems. This indicates that the participants took more time to read difficult problems compared to easier problems, and their response accuracy decreased as the difficulty increased. The comparison between L1 and L2, as well as differences between creativity and difficulty, will be discussed.

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Title: Noun and Verb Production in Broca's aphasia: evidence from Uzbek

Author: Iroda Azimova

Holmes, Marshall, and Newcombe (1971) for the first time described a dyslexic patient who performed on nouns significantly better than verbs in a reading task. Since then a number of studies in brain-damaged individuals reported noun-verb dissociation in different tasks and modalities: writing to dictation, oral picture naming, written picture naming (word to-picture matching spontaneous speech. Researchers explained this dissociation through deep cognitive and semantic universals: nouns are objects and verbs are actions. From grammatical point of view verbs carry more information than nouns. Superiority of verb deficit was explained by extended sensory/functional theory as verbs having more functional features and less sensory features compared to nouns, which makes verbs less imageable than nouns (Bird, Howard, Franklin, 2000). However, recent study by Alyahya, Halai, Conroy, Lambon Ralph (2018) claims that noun-verb dissociation does not occur when psycholinguistic variables are controlled. Current study aims to bring new evidence to the topic from the language which was not studied previously. Thus, the question we want to answer in this work: is there noun-verb dissociation in Uzbek non-fluent aphasia and which kind of factors influence noun-verb retrieval?

Uzbek is an agglutinative language with the rich and complex morphology. Uzbek has been engaged to neurolinguistic research recently and a very few research have been done on aphasia in this language. Spontaneuous speech analysis showed no noun-verb dissociation in Uzbek agrammatic aphasia. In order to find further details of the evidence, a psycholinguistic experiment was conducted. Picture naming task was assigned to the group of individuals with Broca's aphasia (n=4) and to the group of non-brain-damaged individuals (n=7). They were shown line-drawing pictures of objects and actions, and were asked to tell what was described in the picture. In total, 100 pictures (50 for objects, 50 for actions) were presented during the experiment. Target nouns were controlled for semantic group, concreteness, frequency, and target verbs were controlled for argument structure, for frequency, transitivity, name relation and instrumentality.

The results showed individuals with aphasia performed worse than control group in both object and action naming. In control group, the mean of correct answers is 46 for nouns, and 44 for verbs. In experimental group, 32 for nouns, 30 for verbs. The difference between word classes was not significant. In Uzbek, all grammatical meanings expressed via suffixes and their combinations attached at the end of the word. One verb may have more than 100,000 forms including periphrastic forms (Pulatova, Pulatov, Muminova, 2003). Morphologically comlex languages is relatively better preserved in aphasia. The reason of it explained by regularity of expression of grammar rules (Abuom, Bastiaanse, 2012). We assume that this feature of Uzbek is the reason of absence of noun-verb dissociation in Uzbek non-fluent aphasia.

Qualitative analysis of errors revealed influence of age of acquisition and semantic group in noun retrieval, and imageability in verb retrieval. We believe further research of these factors and less explored languages like Uzbek will help us to understand better how words are organized in human mind.

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Title: Measuring English vocabulary knowledge: Variables related to scores on the Vocabulary Size Test

Authors: Alexandra Gottardo and Karimeh Haddad

One of the most commonly used metrics of language proficiency is vocabulary size, which is often considered a proxy for overall language skill (August et al., 2005). Measuring vocabulary knowledge in research contexts can be challenging, given the time frame available for date collection and the number of additional measures being administered. In the current research context of greater reliance on online testing, many measures of vocabulary knowledge traditionally used by researchers are not accessible or easily administered (e.g., the Peabody Picture Vocabulary Test). One proposed solution for measuring language skills is the Vocabulary Size Test (VST: Nation & Beglar, 2007). This written measure was created to examine vocabulary knowledge and growth in English second language (L2) speakers, with the goal of determining vocabulary knowledge necessary to comprehend everyday conversation, interact with media (newspapers) and read novels (Nation & Beglar, 2007). Although the VST contains some difficult words, it was not designed to measure discipline-specific knowledge (e.g., vocabulary associated with psychology versus biology). The present study examined if level of study, immigrant status or GPA were related to performance on the VST in university students to determine the utility of the VST for university students in Canada.

Method: University students (N= 161) were recruited to participate in a larger study examining the effects of immigration status. The students attended a medium-sized university in Canada. The participants included first-generation (N= 38), second-generation (N = 84) and third-generation immigrants (N = 39) (using a definition consistent with Statistics Canada, 2018).

The Vocabulary Size Test (Nation & Beglar, 2007) was administered to participants to provide an estimate of vocabulary knowledge. Participants were asked to read a word presented in a carrier phrase that did not reveal the word's meaning. The word was accompanied by four possible meanings.

Participants had to determine which one of four alternatives was the correct meaning of the word. The measure had high reliability, Cronbach's alpha = .99.

A demographic questionnaire was used to determine immigration status, GPA and level of study.

Results and Discussion: A series of ANOVAs were conducted to examine group differences on the VST using the categorical data. No group differences were found for gender, immigration status (1st, 2nd and 3rd generation) and level of study. When the effects of continuous variables were examined using a multiple regression analysis, only GPA was related to performance on the VST, Beta = .227, $t(2, 158) = 2.91$, $p = .004$.

Although vocabulary knowledge is likely a key factor in a student's GPA, other variables that were expected to be related to vocabulary knowledge did not produce expected results. For example, level of study did not differentiate VST scores. This finding might be the result of the vocabulary items being tested by the measure. Specifically, items included words from everyday conversation and novels, not discipline-specific words that might be learned through coursework or advanced levels of education.

Another interesting and unexpected finding was the lack of group differences based on immigration status. However, the words tested by the VST were intended to measure progress in L2 learners. The VST appears to have some utility for measuring English vocabulary for immigrant university students.

Title: The effect of context and familiarity in the processing of nominal compounds

Authors: Francisco Masao Ito Gómez, John Cristian Borges Gamboa, Juhani Järvikivi and Shanley E M Allen

The Uniform Information Density (UID) hypothesis (Jaeger, 2010) proposes that speakers transmit information at a constant rate, predicting that interlocutors would have difficulty when the amount of information transmitted through time is higher than the channel capacity. Nominal compounds (e.g., waste water treatment facility) are structures able to express complex concepts in just a few words (compare facility for the treatment of water from waste) and therefore pack a large amount of information, at least when they are considered in isolation.

Paradoxically, however, NCs are pervasive in high level academic texts, such as scientific articles or books. How can they be used, if they constitute peaks of information? And why are some of them harder to process than others? (Compare, for example, stress response gene vs. start arm barrier.) One possibility is that their meaning is "set up" in their context so that readers are not surprised when they arrive at the NC. In addition, some common NCs (or NC subparts) may be generally expected or familiar. In this study, we investigate the role of these two variables in the processing of long NCs composed of three words. We determine the degree of context set up computationally by counting the number of words before the NC that are similar (using the cosine similarity of BERT word vectors; Devlin et al., 2018) to the NC constituents, and categorize the NCs according to this count. We determine familiarity using information from the Google Ngram Viewer (Michel et al., 2011) and Wikipedia.

Participants (N=56) filled out questionnaires in which they read 24 text passages containing an NC in their last sentence. NCs were manipulated by familiarity (Low vs. High) and set up "strength" (Weak vs. Strong). After each text passage, participants judged their degree of difficulty in a 1-10 scale (1: very easy; 10: very hard). They also judged their perceived difficulty when considering 24 NCs in isolation. We hypothesized that low set up NCs would elicit higher difficulty, but that this effect would not be present for the NCs in isolation. In addition, low familiarity NCs should also evoke higher difficulty judgments.

In our preliminary results, we analysed separately the data in context and the data in isolation. We found very little difference between the results for NCs presented with context or in isolation. We also found no effect of set up strength, with the judgments of NCs with Weak set up being very similar to those of Strong set up NCs. However, familiarity did play a role in the degree of difficulty experienced by participants, with high familiarity associated with lower response values, both for NCs in context ($t = 7.546$, $p < .001$) and in isolation ($t = 7.095$, $p < .001$). The lack of a context effect, however, may stem from a number of reasons and should not be interpreted as evidence that NCs are not set up by their context. It is quite possible, for example, that our simple counting measure is not sensitive enough, not taking into account useful information such as the structure of the sentences preceding the NC. Still, our data does not provide evidence in favor of the UID hypothesis, leaving its relation to NC use still unexplained.

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Title: The shadow of unused feminitives: online / offline processing of gender agreement in Russian

Authors: Natalia Slioussar and Marina Frolova

Russian language has three genders (M, F, N). The gender of the noun cannot be unambiguously determined from its inflectional affixes (although there are some clear tendencies), but becomes evident from agreeing adjectives, participles and verbs. Like in many other languages, many nouns denoting professions are grammatically M. How to call a female director or a female author?

In Russian, two routes are available. Firstly, a corresponding grammatically F noun (feminitive) can be formed (e.g. zhurnalist 'journalist$_M$' – zhurnalistka 'journalist$_F$'). Russian uses a variety of suffixes to form such nouns, and many M nouns denoting professions do not have an established F counterpart at all. Secondly, Russian has so-called common gender, and an originally M noun can be used with M and F agreement (e.g. nash / nasha vrach 'our$_M$ / our$_F$ doctor'). This route is available for any M noun denoting profession, even when a paired feminitive exists.

Many studies focus on gender agreement with nouns denoting professions in different languages (e.g. Carreiras et al., 1996; Gygax et al., 2008). But it was never investigated how the availability of feminitives influences the processing of common gender (historically M) nouns with F agreement. This question is interesting both for gender linguistics and for theoretical morphology. We conducted two experiments studying online and offline processing: a word-by-word self-paced reading study (N=63) and a grammaticality judgment study on a 1 to 5 scale (N=40). Sentences like (1) were used as stimuli.

(1) V reklame kosmetolog blestjashche prezentoval/prezentovala novyj krem.
in advertisement cosmetologist brilliantly presented$_{M/F}$ new cream
'In an advertisement, the cosmetologist brilliantly resented the new cream.'

The following factors were manipulated: (i) the gender of the predicate (M/F); (ii) the existence of a feminitive (yes/no); (iii) gender stereotypes associated with the profession (M/F, based on the survey reported by Garnham and Yakovlev (2015)). Ordinal logistic and linear regressions with mixed effects (intercepts) by participant / by item were used for the statistical analysis.

We found that online, the existence of a paired F noun does not play a significant role, while stereotypicality does. With stereotypically feminine professions, F and M agreement take the same time to read. With stereotypically M professions, F agreement is processed more slowly, as Fig 1 and 2 show. Statistically, the predicate gender factor is significant only in the latter group; when both groups are analyzed together, the interaction between the predicate gender and stereotypicality reaches significance; the pairdness factor never does. Offline, the situation is the opposite: sentences like (1) with F agreement receive significantly lower ratings if the subject noun has an F counterpart (see Table 1). Gender stereotypes do not play a significant role.

We assume that the pair factor reaches significance only offline because it requires a complex metalinguistic judgment (figuring out that there is another, better way to express the same meaning). We also hypothesize that stereotypicality is significant only online because it influences predictability: F agreement is used more often with stereotypically F professions and is more readily expected after nouns denoting such professions. Judging how natural a sentence

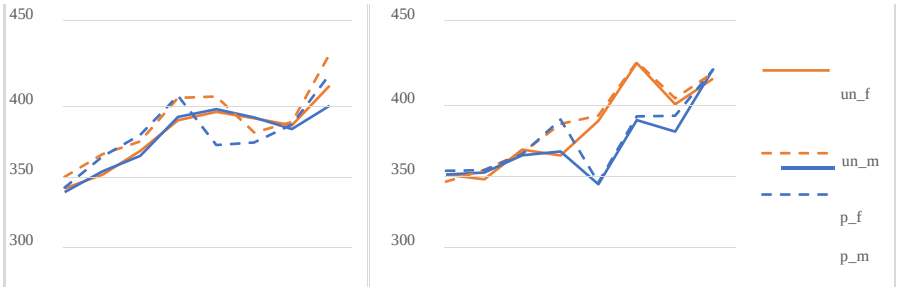

Table 1

stereotypes	with F pair	without F pair
F	3,8	2,8
M	3,7	3,2

sounds, readers do not take stereotypes into account.

Title: Orthographic representations during heritage language processing: Insights from Korean
Authors: Yoolim Kim

More than half of the Korean lexicon comprises words of Chinese origin, or Sino-Korean. Unlike native-Korean words, which can only be written using the Korean alphabet, Hangul, Sino- Korean word can be written using two different scripts. In addition to its written form in Hangul, Sino-Korean can also be written using Hanja (Chinese characters borrowed into Korean). It is also important to note that Hangul is the dominant script of the two, and that Hanja maintains relatively low visibility in written Korean. This presents a complex asymmetry between the visual orthographic representation of words in print (Hangul) and the orthographic information that is potentially encoded as part of the lexical information stored in the mental lexicon (both Hanja and Hangul). The interplay between the dominance of Sino-Korean in the lexicon, and Hangul in written Korean raises interesting questions regarding the extent to which the Sino- Korean stratum in the mental lexicon is represented independently of the presence or knowledge of Hanja. Previous studies indicate native speakers' ability to intuit whether a Korean word is Sino-Korean or not, and suggest that native speakers actively rely on the contributions of Hanja during Sino-Korean processing (Yi, 2003; 2009). However, it remains unclear whether near-native speakers of Korean demonstrate similar processing patterns. Specifically, to what extent are heritage learners of Korean sensitive to the contributions of Hanja during processing? The unique complexities of the relationship between the two scripts and the lexicon itself poses an important opportunity to engage heritage learners or speakers of Korean who demonstrate differential abilities in both written and spoken Korean. As an understudied community of speakers, they demonstrate a nuanced language background, the effects of which are also likely to be observed during processing. In an ongoing study involving lexical decision with semanto-morphological priming, we investigate the status of Hanja in the mental lexicon of heritage speakers of Korean. Crucially, successful parsing of the target stimuli necessarily requires some knowledge of the appropriate Hanja, whether orthographically or conceptually. The findings will be discussed in relation to the possibility that the mental representations of Sino-Korean potentially abstract away from the orthographic representation of Hanja while preserving its semanto-conceptual dimension. These results will also be discussed within the context of the structure of the Korean mental lexicon and the ways in which differences in the encoded lexical information between native and heritage speakers are reflected. Most importantly, these results challenge existing proposals of the structure of the Korean mental lexicon (Yi, 2009), which assume a supra-lexical approach in which morphemic constituents are only accessible by way of activation of the entire word. The present study on heritage learners offers further insights into whether the contributions of Hanja at the morphemic level are accessible before or after full word activation, inviting further discussion of the role of morpho-orthographic representations during processing.

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Title: The Bouba/Kiki effect on gendered objects in the Arabic language

Authors: Ghadir Nassereddine and Lori Buchanan

People are more likely to associate the non-word “bouba” to a round shape, and “kiki” to a sharp shape, an effect known as the Bouba/Kiki effect (Ramachandran & Hubbard, 2001). This also extends to linking of English gendered names to shapes (Sidhu & Pexman, 2015). This effect has not been examined in Arabic, or with words with a grammatical gender. The goal is to evaluate the contributions of grammatical gender and sounds on the Bouba/Kiki effect in Arabic. The question is whether Arabic speakers link feminine objects to the “bouba” shape, and masculine objects to the “kiki” shape and whether this effect is mediated by the letter sound. Shape selection was evaluated in 110 participants. Each participant was presented with 18 feminine and 18 masculine words. One-third of the words had sharp sounds, one-third rounded sounds and one-third mixed. One word was presented once at a time with a “bouba” and a “kiki” shape on opposite sides of the screen below it. Participants selected the shape they thought best matched the word. Analysis of performance showed that the sounds of letters influenced shape selection, gender had no influence, but gender and sounds interact.

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Title: Exploring the Contribution of Set for Variability to Word Reading in Students With Dyslexia

Authors: Laura Steacy, Donald Compton, Ashley Edwards, Alexandra Himelhoch, Valeria Rigobon, Nuria Gutierrez, Nancy Marencin, Noam Siegelman, Cristina Himelhoch and Jay Rueckl

Learning to read requires the coordination of a diverse set of skills. Quasiregular orthographies such as English contain substantial ambiguities between orthography and phonology that force developing readers to acquire flexibility when applying orthographic-to-phonological relations during decoding of unfamiliar words, a skill referred to as a "set for variability" (SfV; Venezky, 1999). The ease by which a child can disambiguate the mismatch between the decoded form of a word and its actual lexical pronunciation has been operationalized using the Set for Variability (SfV) mispronunciation task which requires a child to orally disambiguate the mismatch between the decoded form of an irregular word and its actual lexical pronunciation. For example, in the task, the word wasp is pronounced to rhyme with clasp (i.e., /wæsp/) and the child must recognize the actual pronunciation of the word to be /wɒsp/. SfV has been shown to be a significant predictor of both item-specific and general word reading variance above and beyond that associated with phonemic awareness skill, letter-sound knowledge, and vocabulary skill (Steacy et al., 2019). However, little is known about the relative strength of SfV as a predictor of word reading skill compared to other well established early word reading predictors. In addition, little is known about the relationship between SfV and word reading in children with dyslexia.

In this study, we explore the relative contribution of SfV as a predictor of word reading across the entire distribution of reading skill. We take a dimensional approach to exploring the SfV–word reading relationship in children with dyslexia by examining variation as a function of word reading skill, which does not require the reading distribution to be divided into distinct groups representing dyslexic and typically developing readers. Our sample consisted of 483 elementary school-aged students (grades 2-5) from public schools and private schools for students with dyslexia. Students were tested on measures of SfV, Vocabulary (WASI), Phonological Awareness (PA, Elision Task), Rapid Naming (RAN), Attention (SWAN), and Word Identification. To explore the contribution of SfV to word reading we conducted a series of analyses. First, we used a regression analysis to explore the basic relationships between SfV and word reading while controlling for other reading-related skills. Next, we performed a dominance analysis to explore the relative importance of each predictor in predicting word reading skill. Finally, we conducted a quantile regression to explore the relationship between SfV and word reading at different points on the distribution.

The results from a regression analysis predicting word identification indicate that SfV accounted for 15% of unique variance above and beyond that associated with RAN, Attention, Age, and PA; whereas PA accounted for only 1% unique variance. The dominance analysis allowed us to explore the relative contribution of the predictors. Results indicate that SfV was the most powerful predictor of word reading, completely dominating all other variables including PA. The results of the quantile regression indicate that SfV is a stronger predictor of word reading at lower levels of reading skill, indicating that it may be an especially important predictor in students with dyslexia.

We report strong age-corrected correlations between SfV and word reading (r=.78) in a sample of 489 children in grades 2-5. As a predictor of word reading variance, SfV was found to

completely dominate other important word reading related measures, most notably PA skill, included in the model. In addition, the SfV-word reading relationship was found to be strongest at the lower end of the distribution. We conceptualize our results within an item-base acquisition model of early word reading (i.e., orthographic word learning) in which phonological decoding results in stored spelling pronunciations (i.e., decoded forms) that are linked to both the phonological form and spelling of a word. As described by Elbro and de Jong (2017), these stored spelling pronunciations are available for, and facilitate, both word reading and spelling in developing readers. We speculate that the SfV task in the bottom end of the word reading distribution may represent a pure measure of phonological cleanup that is less contaminated by the presence of stored spelling pronunciations and feedback from stored spelling representations.

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Title: Identifying the Role of Context in Novel Noun Compound Interpretation
Author: Tiana Simovic and Barend Beekhuizen

Noun compounding is a productive word formation strategy in English, characterized by a high degree of creativity and efficiency. Low-frequency (hence: 'novel') noun compounds like animal teacher often elicit diverse interpretations (e.g., Schäfer and Bell, 2020), suggesting that they are semantically underspecified and challenging to interpret out of context. Further, novel compounds derive much of their meaning from their surrounding context (e.g., Downing, 1977; Girju et al., 2005). We explore exactly how much the role of sentence context changes default interpretations of novel English noun compounds by considering naturally occurring (corpus-derived) sentence contexts. We consider compounds with two plausible interpretations: of-relations (teacher OF animals) and is-relations (animal who IS a teacher). We predicted context would increase participants' ratings of the plausibility of given compound interpretations and that certainty would differ between relations.

We selected 92 novel noun compounds (occurring 1-3 times in the corpus) from the Corpus of Contemporary American English (COCA; Davies, 2008). All compounds were headed by one of five agentive-head nouns (driver, instructor, leader, teacher, trainer). Participants (N = 40; M_{age} = 33.38 years; SD_{age} = 14.29 years) were recruited from Prolific and were native or near-native English speakers. Participants saw a selection of the compounds in two blocks. Block 1 showed each target compound out of context, and participants were asked to provide a rating on a slider scale from 0 (implausible) to 100 (totally plausible) in response to a prompt like "How plausible is it that animal teacher means a teacher of animals?". In block 2, participants first saw the compound in its context sentence from the corpus and were then asked to provide a rating in response to the same prompt. We also varied whether the prompt contained an is-relation ("...means teacher OF animals?") or an of–relation ("...means teacher who IS an animal?").

Participant plausibility ratings showed of-relations were more interpretable out of context (M=68/100 rating) than is-relations, which were rated closer to chance level (M=53.5/100). Beta regression modelling showed a significant effect of context presence (β=-0.16, SE=0.06, z=-2.87, p<.01). The results suggest that context increases interpretation certainty, particularly when prompted with an of-relation. However, several groups of cases notably defy this pattern. We are currently developing models that use contextualized vectors to identify aspects of context that are critical to novel noun compound interpretation.

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Title: Lexical connectivity effects in paired-associate learning and serial recall

Author: Matthew Mak, Yaling Hsiao and Kate Nation

In 9 experiments, we tested whether paired-associate learning and immediate serial recall are influenced by a word's degree centrality, an index of lexical connectivity. Words of High degree centrality (e.g., food) are associated with more words in free association norms (De Deyne et al., 2019) than those of Low degree centrality (e.g., bless).

In paired associate learning (PAL), we reanalysed an existing dataset (Qiu & Johns, 2019), in which young adults remembered 40 cue–response word pairs (e.g., nature–chain) and completed a cued recall task (e.g., what word was paired with nature?). Experiment 2 is a preregistered replication of this existing study. Experiment 3 addressed some limitations by using pseudowords as the response items (e.g., boot–arruity). The three experiments converged to show that cue words of higher degree centrality facilitated the recall/recognition of the response items, providing support for the notion that better-connected words have a greater ability to acquire new links (i.e., preferential attachment / the rich get richer).

In serial recall, we re-analysed four existing datasets and conducted five experiments using a range of list composition: 1. Scrambled (e.g., HHHLHL, LHHLLH), 2. Pure (e.g., HHHHHH vs. LLLLLL), and 3. Alternating (e.g., HLHLHL vs. LHLHLH). These experiments converged to show that (i) High-degree words have greater accessibility than low-degree words, (ii) High-degree words can facilitate the formation of inter-item association, and (iii) The effect of degree centrality on serial recall is distinct from that of frequency.

Overall, evidence from paired-associate learning and serial recall converged to support the notion that the adult lexicon continues to grow in accordance with the principle of preferential attachment (i.e., the rich get richer) (Mak & Twitchell, 2020; Steyvers & Tenenbaum, 2005)

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Title: The effect of reduction position on typing accuracies of Estonian spontaneous speech
Authors: Kaidi Lõo, Fabian Tomaschek, Pärtel Lippus and Benjamin Tucker

Words are often pronounced more reduced in spontaneous speech than in a laboratory setting (Johnson 2004, Ernestus & Warner 2011). For example, in English spontaneous speech about 22% of the tokens have at least one segment deletion compared to the dictionary form (Dilts 2013), in Estonian this number is about 7% (calculated based on Lippus et al. 2020). Such reductions hinder the perception of words in isolation (Ernestus et al. 2002). However, not much is known about the reduction in morphologically complex words. In particular, it is unknown whether reduction differently affects perception depending on where it occurs within the words?

We investigated this question in the data from an online typing experiment in which 125 native Estonian speakers (92 females and 33 males, age range 18-65 years) were presented to 1000 isolated inflected nouns (4 lists, 250 nouns in each) randomly selected from the Estonian spontaneous speech corpus (Lippus et al. 2020). The material was extracted from continuous speech context. The reduction in the stimuli was quantified as deletions of segments in the pronounced form compared to the dictionary form. We coded whether nothing was reduced (e.g., poisi-d 'boys'), or whether reductions occurred in the base (e.g., posi-d), in the suffix (e.g., poisi) or in both (e.g., posi). Participants were asked to listen to the stimuli and type in what word they heard. We investigated whether the entire inflected word (e.g., poisi-d 'boys'), or only the base (e.g., poisi-le 'for the boy') or only the suffix (e.g., posti-d 'posts') was typed correctly. The table below illustrates the typing accuracy depending on the place of the reduction. We find that the base accuracy was the highest and the suffix accuracy the lowest across reduction positions. The suffix accuracy remained below 50% regardless of whether the reduction occurred in the base or in the suffix. The base accuracy was over 50% even when the reduction was in both.

	Accuracy Base	Accuracy Suffix	Accuracy Form
Nothing Reduced	85%	68%	79%
Base Reduced	64%	45%	53%
Suffix Reduced	74%	26%	37%
Base and Suffix Reduced	53%	22%	21%

These results support interactive bi-directional models of word recognition and morphological processing as they can handle degraded speech (e.g., McClelland et al. 2006). However, the correct perception of a whole reduced form is only possible to an extent. As Estonian suffixes are short, the perception of reduced suffixes, at least in isolation, is particularly difficult. This may be because they are often not clearly articulated as they can be predicted from the following context in the continuous speech (see Lõo et al. 2021). However, it seems that usually the listeners are able to receive the necessary information also from a partial form. Future experiments with reduced complex word forms in a sentence context are planned.

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Title: The role of consonants and vowels as a cue for word borders in auditory perception is shaped by language-specific properties: Evidence from Hebrew and English

Authors: Yaara Lador Weizman and Avital Deutsch

This study compared the role of consonants and vowels as a cue for word segmentation in auditory speech perception, in Hebrew versus English. It focused on the relative importance of transitional probabilities (TPs) between non-adjacent consonants versus vowels in the course of learning an artificial language.

The asymmetrical contribution of consonants and vowels in spoken (or written) word processing, with consonants holding greater importance than vowels, is a well-documented phenomenon, termed the "Consonantal Bias" (C-bias). What precisely underlies the C-bias is a controversial issue. According to one view, the C-bias is a universal constraint of speech perception; a second view maintains that it is modulated by linguistic factors. The two views thus make different predictions for consonant-vowel asymmetries across languages. The way to resolve this controversial issue lies partly in cross-linguistic comparisons.

This asymmetry between consonants and vowels has been investigated in various languages from different linguistic families, using various tasks. For the most part, Indo-European languages have demonstrated a C-bias, with a reverse pattern of Vowel-bias in Sino-Tibetan languages. The case of Hebrew, with its peculiar Semitic morphological structure that dominates early processes of lexical access in written-word perception and word production, has the potential to contribute to this debate. Specifically, the two most influential derivational morphemes that mediate lexical access in Hebrew – the consonantal root and the vowels (or vowels + consonants) word pattern – partially overlap with the phonemic distinction between consonants and vowels. Thus, if consonant/vowel asymmetry is indeed modulated by language-specific properties, given the central role of morphological units in lexical access in Hebrew, the Hebrew language is predicted to exemplify a unique pattern of asymmetry, with an expected enhanced C-bias effect. This prediction was recently confirmed by a pioneering study in Hebrew, wherein an enhanced C-bias effect was demonstrated for typical Hebrew words constructed from a root morpheme embedded within a word-pattern morpheme, compared to foreign words that penetrated into Hebrew but do not have a typical Semitic structure (Lador-Weizman & Deutsch, 2022).

The current study continued this line of research by conducting a direct, between-languages comparison. Most of the previous studies in European languages that were based on artificial-language learning paradigms showed that TPs between segments are more robust for consonants than for vowels (e.g., Bonatti et al., 2005). To test the claim that Hebrew deviates from Indo- European languages and exhibits an enhanced C-bias, native Hebrew and English speakers performed the same task of artificial-language learning in a within-stimuli, between-subjects design. In line with the hypothesis that Hebrew speakers are particularly sensitive to consonants, better computation of non-adjacent consonantal TPs was predicted for Hebrew speakers than for English speakers. Participants heard a continuous string of three-CV-syllable "words", like [samite] or [motabi] in the consonantal continuous string or in the vowel continuous string, respectively. The TPs between consonants within a word in the consonantal string was 1, and up to .5 between consonants between words, as well as between vowels. (A reverse ratio was constructed for the vowel string.) Fifty participants within a language were tested in the consonant or the vowel string. After listening to the stream, the participants were presented with 39 questions that tested their ability to identify the embedded words within the string.

As predicted, the results revealed a significant interaction between language and the consonant/vowel manipulation, demonstrating that the bias towards higher performance in the consonantal condition was stronger for Hebrew speakers than for English speakers. These results accord with the view that the asymmetry between consonants and vowels is a language-specific phenomenon. We suggest that the observed interaction is morphologically anchored, indicating that phonological and morphological processes interact during early phases of auditory word perception.

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Title: Breeding hate in the lab: investigating lexical valence as a window into intergroup bias
Author: Daniel Schmidtke and Victor Kuperman

Introduction: Intergroup bias describes the universal human tendency to divide social groups into us and them with a preference for us (the in-group) over them (the out-group). The proclivity towards regarding the in-group more favourably than the out-group is manifest in prejudice, stereotyping, and discrimination (Hewstone et al., 2002). Across a series of experiments, the present study investigates an aspect of human behavior that pervades all levels of inter-group bias, -namely, language usage. We examined two main hypotheses. First, we considered the influence of group membership on the affective evaluation of the in- vs. out-group. A well-established theoretical prediction is that given the same input, i.e., ground truth, people will evaluate their in- group more positively than the out-group. Yet, to our knowledge, no numerical estimates exist on how strongly group membership affects the difference in these affective evaluations, and how this difference is related to the positivity of the available information regarding the group under evaluation. Second, we scrutinized the Linguistic Intergroup Bias (LIB) hypothesis (Maass et al., 1989), which predicts that negative verbal evaluations are construed in concrete terms for the in- group and in abstract terms for the out-group, yet positive verbal evaluations are expected to be concrete for the out-group and abstract for the in-group.

Method: A written word production task was administered to participants who were randomly assigned to one of two conditions (an in-group condition and an out-group condition). Both groups were presented with the same set of three "seed" words. Participants in the in-group condition were told that the seed words described their own group and based on these descriptions, were asked to provide three more words to describe their group. Participants in the out-group condition were told that the seed words described an out-group and were asked to provide three additional words to describe that out-group. The valence (emotional positivity) and concreteness characteristics of the words produced by the participants served as the outcome variables.

Findings: Addressing the first hypothesis, we found significant ($p < .05$) differences between in- and out-group verbal evaluations. The difference in the lexical valence of the responses was driven by an inflation in positivity about the in-group rather than an amplification of negativity about the out-group. Furthermore, the in-group was associated with substantially more positive evaluations than the outgroup regardless of the valence of the input words. In a follow-up experiment, we adopted the linear diffusion chain method (Kirby et al., 2008) wherein the verbal evaluations provided by participants served as the input for a next generation (group) of participants completing the same task. Across a total of 5 generations, the initial difference in positivity of the in-group relative to the out-group grew significantly larger at each subsequent generation. The same was true of the negativity bias toward the out-group: it became stronger with each next iteration of the diffusion chain. These results indicate that the intergroup bias effects on verbal positivity intensify as they propagate through generations. Our results can be interpreted within a cumulative cultural evolution framework: intergroup biases lead to the formation of stable stereotypes as they propagate and perpetuate over multiple social generations.

Last, all our findings run counter to all predictions of LIB. In the first generation of responses, no systematic pattern was observed in how concrete or abstract verbal responses were across the in- or out-group evaluations, at any value of seed valence across the valence range. Across

multiple generations, in-group responses grew more abstract when seed words had low to mid valence, again contradicting the predictions of the LIB prediction. We argue that the general pattern that can be gleaned from the concreteness data is more parsimonious than LIB: Affective evaluations that are more positive are also more concrete, regardless of group membership.

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Title: Do Spoken Word Representations in the Mental Lexicon Contain Distinctive Features?
Authors: Danny Moates, ZS Bond and Nathan Starkey

In linguistics, distinctive features have been part of phonological descriptions at least since the seminal work of Jakobson, Fant and Halle (1951). Whether distinctive features are also part of the mental representations of words is less clear. Stevens (2005) assumed that words are represented by phonemes which in turn are represented by bundles of distinctive features.

Word identification involves matching the features in the acoustic signal and the bundles of distinctive features in the mental representation. The TRACE model (McClelland & Elman, 1986) also begins word recognition by identifying features in the acoustic signal which combine to identify phonemes. We can say that two phonemes that differ in only one distinctive feature (e.g., /d,t/) have a feature difference of one. Two phonemes differing in two distinctive features (e.g., /d, k/) have a feature difference of two. Feature differences are readily identified in phonological analyses; do they also manifest themselves in behavioral tasks such as word recognition? Feature difference effects have been shown by Bölte (1997 in a lexical reconstruction task that showed a difference between FD1 and more than one. Moates, Bond, Stockmal, and Lee (2013), also using a lexical reconstruction task, found more errors as differences increased from FD1 to FD3. Connine, Blasko, and Titone (1993) found semantic priming with one or two feature mismatch but no priming with a greater mismatch. Milberg, Blumstein, and Dworetzky (1988), also using semantic priming, found that primes which differed in one feature from a real word were effective, but those differing in two features were not. No study gave evidence of more than three levels of FD. In the present study 52 pairs of spoken prime-target pairs were presented in a lexical decision task. Half the targets were words, half were nonwords. The primes of interest were nonwords differing from their word targets only in the initial segment, e. g., dattle – battle. The differences ranged across five levels of feature difference, e.g., fugar-sugar(1) , doters-voters(2), megion-region(3), moosing-losing(4), gestern-western(5). Participants pressed a word key or a nonword key for each target. The computer measured accuracy and latency of each response. We hypothesized (1) Form priming shows increasing accuracy as feature difference shifts from 1 to 5. When prime and target are similar, the prime elicits a cohort of words that contains the target, leading to inhibition (Dufour & Peereman, 2003). (2) Latency shows decreasing response times as feature difference changes from 1 to 5, following the same logic. A second variable, noise/no noise background, served as a research question. Given the large literature showing noise effects (Pisoni, 1996), does the feature difference effect change with noise? We used a multilevel modeling analysis, which is appropriate for both the binary DV of accuracy and the continuous DV of latency (Locker, Hoffman, & Bovaird, 2007; Raudenbush & Bryk, 2002). It showed significant main effects for both FD and Noise for both accuracy and latency but no interactions. Paired comparisons of levels of FD showed FD1 to be significantly different from all other levels with no other significant differences. The noise variable showed no noise to be more accurate and faster than noise. The FD effect was limited to FD1 vs all others, consistent with the findings in earlier studies. Converging operations from these studies suggest distinctive features do exist in lexical items but not in a way that accords directly with phonological theory.

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Title: The Effects of Technology use on Literacy, Self-regulation, and Well-being in Children in Pakistan

Authors: Sonaina Chopra, Alexandra Gottardo and Amna Mirza

Previous literature illustrated the use of technology and its impacts on children in areas such as educational achievements, physical and cognitive development, and socio-emotional effects (Goldschalk, 2019). These studies have mostly been done in developed countries and high-incoming populations. Pakistan, being low to a middle-income country, does not account for the sample space of these studies in terms of technology use. In Pakistan, differences exist between urban and rural areas based on levels of education, educational systems, socioeconomic status, access to the Internet or technology, literacy rate, and parental involvement in children's education, with rural areas being lower on these variables (Siddique, 2012; Stryjak & James, 2016). The present study investigated differences in literacy, self-regulation, and well-being in children in urban and rural areas.

The data was collected from sixty participants, mother-child pairs (N= 60), thirty (N=30) from rural areas, and thirty (N=30) from urban areas via Zoom. Assessments included a technology use questionnaire to look at the difference in technology use between two groups, the Expressive One-Word Picture Vocabulary Test (EOWPVT), and a word reading test for literacy, The Head, Toes, Knees, Shoulders test (HTKS) for self-regulation, and the Strengths and Difficulties Questionnaire for well-being.

Children from urban areas scored higher on technology use, vocabulary, word reading, and self-regulation but no significant difference was found in well-being. Results suggest that vocabulary is significantly correlated with self-regulation, $r = .494$, $p < .001$, and age $r = .608$, $p < .001$, but not with word reading and well-being for urban areas. Similar correlations were found but unlike in urban areas, total vocabulary is correlated with word reading, $r = .622$, $p < .001$, for rural areas. Regression analyses revealed that word reading predicted a significant proportion of variance in the vocabulary, $R2 = .388$, $F(3,29) = 5.49$, $p < .001$, for rural areas but no significant relations were found for urban areas.

This study showed that children's vocabulary, word reading, and self-regulation are associated with access to resources. For future research, parental involvement and individual differences in literacy can be taken into consideration.

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Title: Morphological regularities across Semitic words: do they support word learning?
Author: Niveen Omar

The current study investigates the effect of morphological regularities created by Semitic-like words on word 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 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 role of these morphemes and especially the syllabic patterns in bottom-up word learning. Words that share a morphological pattern create an environment of regularities at the formal and conceptual levels. For example, the group of words cahevèt 'jaundice', xazerèt 'measles', and kaxelèt 'methemoglobinemia' share the same morphological pattern. These words are related phonologically by sharing the template 'CaCeCèt', conceptually by sharing the meaning of 'illness', and morphologically by sharing the same form-meaning association.

To date, it is still not clear whether regularities created by the morphological patterns influence word learning. The present study aims to answer this question, focusing on the accuracy of naming novel concepts by novel Hebrew-like words following brief exposure to these words. We created four learning conditions, each including six novel Hebrew-like words that create different levels of regularities. In the Morphological condition, the words shared syllabic patterns that encode superordinate meanings (manners-of-motion). In the Conceptual condition, words shared only the superordinate meanings. In the Phonological condition, words were only phonologically similar by sharing syllabic patterns that do not encode any meaning. In the Control condition, the words differed in both form and meaning. In each condition, the visual characters and their auditory names were presented 10 times. Following each condition, the production of the character names was examined. Eighty-four native Hebrew-speaking adults participated in the four learning conditions, twenty-four participants in each.

The results showed that phonological but not conceptual regularities contributed to the accuracy of the word-forms production. The same effect was not found when the phonological regularities were related to conceptual regularities in the Morphological condition. These findings indicate that Semitic nonadjacent syllabic patterns not only influence the way words are represented in the mental lexicon but also the way they are learned bottom-up. The existence of this effect only when the encoded concepts were distinct indicates that the different dimensions of the morphological pattern (i.e., phonological and semantic) may play a different role in the process of word learning and their representation in the mental lexicon.

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Title: The impact of Bilinguals' Spoken Language Usage on English Reading Comprehension
Authors: Kim Thériault, Madison Lester and Vanessa Taler

Introduction: Reading is a complex cognitive process in which readers must use their knowledge to understand the meaning of written words (Li & Clariana, 2019). Reading comprehension is influenced by the reader's own language abilities, especially the ability to speak fluently in more than one language, also known as bilingualism (Li & Clariana, 2019). Most research examining the effect of bilingualism on reading comprehension has focused on young children without considering other age groups (Gelderen et al., 2007; Papastefanou et al., 2021). These studies have found that bilingual children have superior language skills in the language that they use more often (Litcofsky et al., 2016; Place & Hoff, 2016).

Objectives and methods: The current study aims to examine the effect of bilingualism on English-reading skills in young adults who speak English as first or second language, using data from the English Reading Online (ENRO) study. In this study, we examined how spoken language usage in different settings (at home, with friends, etc.) influenced reading performance. Participants (aged 17-30) were English monolinguals (n=181), bilinguals who spoke English as their first language and French as their second (English L1 bilinguals, n=221), and bilinguals who spoke French as their first language and English as their second (English L2 bilinguals, n=51). All participants completed nine tasks evaluating their English reading comprehension and other related skills.

Results: Overall, monolinguals and English L1 bilinguals outperformed English L2 bilinguals on the reading comprehension tasks, while monolinguals and English L1 bilinguals performed similarly. We found that bilinguals who used more English than French across different environments had greater English-reading skills.

Conclusion: The findings suggests that language skills in bilinguals depend on how frequently they use each language in different environments. The current study helps us better understand how different language environment can contribute to someone's linguistic knowledge.

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Platform Session 1.4

Title: Which learning mechanism best explains the learning of serial patterns?

Authors: Fabian Tomaschek, Michael Ramscar and Jessie S Nixon

Speech comprises a series of serial articulatory patterns that represent the sentences, words, etc. of what we call 'grammar.' Attempts to explain the acquisition of these patterns — especially in infancy — typically assume either a statistical [2, 6] or discriminative [4, 3] learning mechanism. Here we examine which of these two mechanisms best accounts for the results of two learning experiments in which participants responded to single letters presented in a sequence of 2000 trials. Unbeknownst to the participants, the letter sequences were governed by an underlying 'grammar'. We expected response latencies to decrease in proportion to a letter's predictability conditioned on previous trials. We operationalised 'statistical learning' with trial-dependent conditional probabilities of letters. 'Discriminative learning' was operationalised by training a neural network in a trial-by-trial fashion to predict upcoming letters, using the Rescorla-Wagner learning rule [5] (implemented in [1]), and calculating the activation of upcoming letters as a measure of predictability. Our predictions were borne out – participants responded faster when upcoming letters became more predictable across the experiment (see Figure 1). Moreover, we found that learning measures on the basis of discriminative learning provided a better fit to response latencies than those on the basis of statistical learning – as indicated by comparisons of ML-scores (Δ-ML score: -100 in Exp. 1 and -30 in Exp.2).

We also investigated whether a particular kind of structure in the pattern is necessary to trigger learning by modulating the grammar of the trial sequences. In the first experiment, sequences were governed by a steady state grammar that mirrored morphological processes in natural languages. By contrast, the letters in the second experiment were presented in a random sequence. The randomisation resulted in some two- and three-trial sequences being more frequent than others, potentially resulting in learning. In both types of sequence (Exp 1 and 2), learning did occur. However, in the case of the steady state grammar (Exp 1), participants integrated up to three trials in a row to learn to predict letters in upcoming trials. By contrast, in the random sequence (Exp 2), only the preceding trial was used, demonstrating that an increase in structure reduces uncertainty and increases learnability. In conclusion, these results indicate that it is discriminative rather than statistical learning that offers the better account of how grammatical knowledge such as morphology (or even syntax) is implicitly learned.

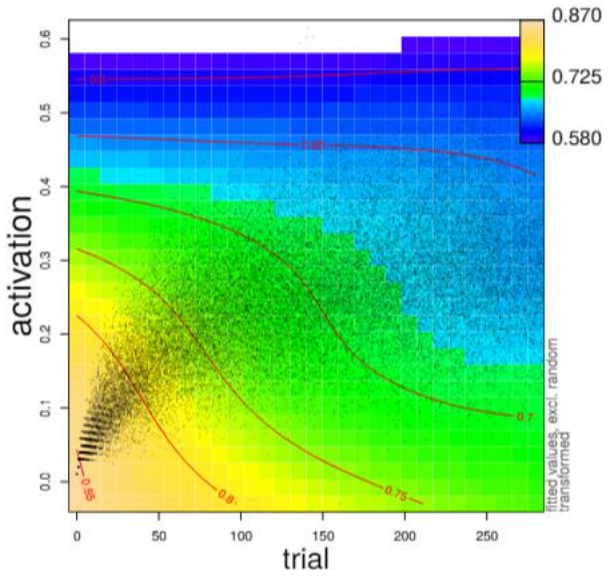

Figure 1: Estimated response latencies in seconds (color coded) as a function of trial (x-axis) and activation (y-axis).

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Title: Modelling trial-to-trial learning in lexical decision with Linear Discriminative Learning

Author: Maria Heitmeier, Yu-Ying Chuang and Harald Baayen

Throughout their lives, humans constantly update their beliefs about the world when encountering new information, which changes how they perceive and react to the world (e.g. O'Reilly and Rohrlich, 2018; Ramscar, 2016). In psycholinguistics, this is observed in priming and antipriming studies where previously observed stimuli influence the pro- cessing of subsequent stimuli. (Anti)priming can be modelled with the Rescorla-Wagner rule (Rescorla and Wagner, 1972), a mathematical account of error-driven learning (Mar- solek, 2008), by assuming that the learning of the prime influences processing of the tar- get stimulus. This implies that participants are continuously learning in priming studies, and predicts that they are also learning in each trial of other psycholinguistic experiments such as lexical decision. The present research question is therefore whether trial-to-trial learning in the mental lexicon can be detected in large-scale lexical decision experiments. So far, computational models of trial-to-trial learning and priming in the mental lexicon used simplified semantic representations with only a few experimental items (e.g. Oppen- heim et al., 2010; Lentz et al., 2021). Linear Discriminative Learning (LDL; Baayen et al., 2019) on the other hand is a model of the mental lexicon with cognitively more plau- sible meaning representations from distributional semantics (e.g. Mandera et al., 2017), thus providing a more fine-grained account of the mental lexicon than previous models. Moreover, it is able to model incremental learning with the Widrow-Hoff rule (Widrow and Hoff, 1960). To test our hypothesis we used data from the British Lexicon Project (BLP; Keuleers et al., 2012), a large-scale lexical decision dataset. We simulated the lexical decision experiment with LDL on a trial-by-trial basis for each subject in the BLP individually. Then, reaction times for both words and nonwords were predicted with Generalised Additive Models (GAMs; Wood, 2011), using measures — such as a stim- ulus' semantic density, or a learned measure of how much its sublexical cues support a word response ("yes-activation") — derived from the LDL simulation as predictors. After having developed the best models with the data of subjects 1 and 2 only, we tested the models on all other subjects. This procedure ensured the generalisabilty of our results. In order to answer our research question, we ran two simulations for each subject: one with learning updates between trials and one without. We extracted measures from both simulations, and used them as input to two GAMs. Then we compared the model fit of both models with Akaike's Information Criterion.

Learning-based models showed better model fit than the non-learning ones for 85% of the subjects for words (mean/SD AIC difference: 35.2/40.8), and for 94% for nonwords (55.7/45.8). Analysis revealed that "yes-activation", only available for learning models, contributed to this difference especially for nonwords. When keeping predictors equal in both models, the difference for nonwords was less pronounced (words: 82% (35.2/40.7); nonwords: 60% (3.0/24.7)). Possibly, trial-to-trial learning in the mental lexicon affects mostly words, while processing of nonwords is influenced more by form-based sublexical processing ("yes-activation"). Our measures also provide insights into processing in the mental lexicon. For example, both higher semantic density and sublexical support for a word response speed up reactions for words and slow them down for non-words.

We conclude from these results that trial-to-trial learning in the mental lexicon can indeed be detected in large-scale psycholinguistic experiments such as the BLP. The present study therefore

extends previous work applying error-driven learning to modelling trial- to-trial effects by modelling within-experiment learning with a much more detailed model of the mental lexicon that integrates distributional semantics with statistical learning.

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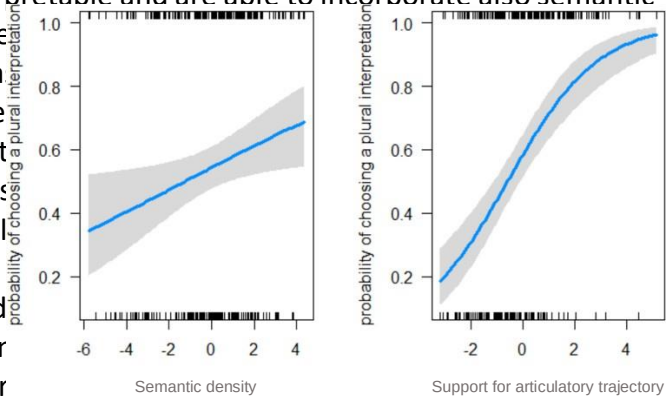
Title: Modeling German plural recognition in aphasia with discriminative learning
Authors: Ingo Plag, Maria Heitmeier and Frank Domahs

German noun plural formation took center stage in the debates about the architecture of the lexicon, morphology and grammar in the 1990s. More recently, computational studies using deep neural networks have tackled the problem of irregularity and semi-regularity characterizing the German noun system (e.g. McCurdy et al. 2020, Dankers et al. 2021). From a linguistic point of view, however, deep learning networks are black boxes. In this paper we employ an alternative to deep learning networks, linear discriminative learning (LDL, Baayen et al. 2019). LDL networks are linguistically interpretable and are able to incorporate also semantic proper- ties. We test whether measures gle grammatical number decisions of an apha singular noun phrases. The data for the prese tested grammatical number decisions of a pat that the accuracy of the patient's decisions conformed to the prototypical, phonologicall 1993).



Following the implementation procedures d nouns, we used word2vec vectors as ser representations to create two-layer networ semantic representations (modeling comprehension), and semantic representations onto form representations (modeling production). We then used the association measures between form and mean- ing to predict the grammatical number of a given word form (to model the German noun plural system), and to predict the number decision by the patient when confronted with a given singu- lar or plural form (to gauge the influence of the healthy system on the patient's system).

The LDL measures very successfully distinguished between singular and plural forms, as shown in the t-SNE plot in Fig. 1: red dots (for singulars) and green triangles (for plurals) cluster separately. In logistic regression models with LDL measures as predictors for the num- ber decision of the aphasic patient, the LDL measures also turned out to be highly predictive. Plural decisions are favored for word forms that live in a denser semantic network, and whose articulatory trajectory has stronger support from the word's semantic vector. This is shown in Fig. 2.

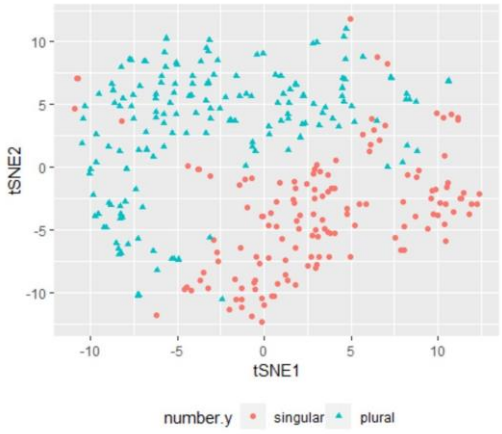


Fig. 1: tSNE plot of LDL measures by number

Fig. 2: Partial effects of regression model

These results have important theoretical implications. First, they show that semantics may play a decisive role in the marking of German plural. Second, they show that LDL is a viable alternative to linguistically uninformative neural networks, and to traditional structuralist schema accounts. Finally, the results provide further support for the idea that behavioral patterns can be understood as emerging from the distributional properties of words on the one hand, and basic principles of human learning on the other.

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Day 2: October 13, 2022
Symposium: Social and Situated Semantics (Platform Session 2.1)

Title: Exploring the role of socially-based contextual diversity in idiom processing
Authors: Marco SG Senaldi, Debra Titone and Brendan T. Johns

The purpose of the present contribution is to shed light on the underexplored role of socially-based contextual diversity as a predictor of idiom processing. While traditional accounts of the lexicon assigned a primary role to frequency in determining the relationship between language environment and linguistic behavior (Broadbent, 1967), more recent corpus-based models of the lexicon have revealed that measures of contextual and semantic diversity are more reliable predictors of language behavior data (Adelman, Brown & Quesada, 2006; Jones, Johns, & Recchia, 2012). Contextual diversity modifies frequency by ignoring word repetition in context, while semantic diversity takes into account the semantic redundancy of contexts. Using a 55-billion word corpus of Reddit comments, Johns (2021) further demonstrated that an even closer fit to language processing data is obtained with socially-based measures of contextual diversity, which keep track of the communication patterns of individuals across different discourses (i.e., subreddits). While most of this evidence has been collected at the single-word level, a wealth of psycholinguistic and corpus-based studies has indicated that most of our linguistic production is actually composed of recurrent and more structurally complex units, including multiword phrases and idioms (Christiansen & Arnon, 2017). In this work, we wanted to verify if the superiority of socially-based measures of contextual and semantic diversity is confirmed also for multiword and idiomatic units. Using the same Reddit corpus as Johns (2021), we computed a set of contextual, semantic and socially-based diversity measures for 210 verb-noun English idioms taken from Libben & Titone's (2008) norms and compared their performance in predicting human-elicited ratings of idioms' familiarity and meaningfulness contained in the same norms. Results confirmed that corpus-based indices measuring diversity of social context provide a closer fit to lexical behavior data with respect to frequency and canonical diversity measures also for multiword expressions. Intriguingly, these results seem to imply that multiword and idiomatic phrases exhibit parallel lexical organization dynamics as single words. We conclude our investigation by discussing preliminary analyses aimed at using the same corpus-based diversity variables to predict online (i.e., eye-tracking) measures of idiom processing.

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Title: Socially Grounded Computational Models of Language: A New Direction for Formals Models of Language Processing

Authors: Brendan Johns

Lexical representations are derived from the surrounding environments that human occupy, and these environments contain significant complexity at multiple levels, from the social to the perceptual to the linguistic. This presents a challenge to cognitive models seeking to integrate realistic representational assumptions into their modeling architecture. The rapid rise of big data sources, and corresponding machine learning algorithms that can exploit these data sources, has made understanding the informational complexity of these sources possible. In the cognitive sciences, the area where the impact of big data and machine learning has been most pronounced is in the study of lexical semantics (see Günther, Rinaldi, & Marelli, 2019 and Kumar, 2020 for recent reviews), beginning with the classic Latent Semantic Analysis (LSA) model of Landauer and Dumais (1997). This model type is referred to as distributional models of semantics.

However, an early criticism of these models is that they ignore extra-linguistic information, most notably grounded and embodied information (e.g., Perfetti, 1998). Due to these criticisms, a current trend in distributional semantic modeling in both cognitive and machine learning research is the integration of perceptual information into the lexical representations of words (e.g., Bruni, Tran, & Tran, 2014; De Deyne, Navarro, Collell, & Perfors, 2021) in order to ground these models in the perceptual world.

However, there are other extra-linguistic types of information that standard distributional models ignore. In particular, they do not include social information about language usage, even though this information type is considered central to developmental theories of language, such as in usage-based (Tomasello, 2003) and adaptive (Beckner et al., 2009; Christiansen & Chater, 2008) approaches. These theories are based on the idea that language is a fundamentally communicative and a social tool and is acquired through the examination of how others use language.

Thus, the integration of socially-based information into computational models of language processing may allow for additional variance to be accounted for by distributional models. This talk will describe modeling work integrating socially-based information into models of lexical organization (Johns, 2021a, 2022) and lexical semantics (Johns, 2021b), derived from mining the online communication patterns of hundreds of thousands of individuals from the discussion forum Reddit spanning over 55 billion words of communications. The results will show that building measures of lexical strength based on these training materials allowed for benchmark fits to a variety of different behavioral measures, such as lexical decision (Johns, 2021a), recognition memory (Johns, in press), and idiomatic processing (Senaldi, Titone, & Johns, 2022). Additionally, it will be shown that social information allows for unique signals of word meanings to be captured (Johns, 2021b).

Language is not tied to just the words that are used, but instead it is embedded in a highly complex and multi-faceted environment. The implication of this work suggests that for corpus-based models of language processing to continue to improve, extra-linguistic information needs to be considered. The results of this work suggest that social and communicative information may prove fundamental in developing more complete computational models of language processing.

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Title: Social Semantics: Investigating Socialness as a Dimension of Word Meaning

Authors: Penny Pexman, Veronica Diveica and Richard Binney

It has been proposed that social significance is a key feature in the representation of some concepts (Barsalou, 2020; Barsalou & Weimer-Hastings, 2005; Borghi & Binkofski, 2014; Borghi et al., 2019; Harpaintner et al., 2018; Ross & Olson, 2010; Simmons et al., 2010; Troche et al., 2014; Zahn et al., 2007). Despite the prevalence of this idea, there is limited consensus about the definition of 'socialness', the behavioural consequences of socialness, or how socialness is related to other dimensions of word meaning. The goal of the present work was to address these issues.

Many previous studies focused on a word's reference to social interaction by measuring, for example, the extent to which a concept refers to relationships between people (Troche et al., 2014) or how often its referent involves interaction between people (Lin et al., 2019; Wang et al., 2019). In contrast, other definitions emphasize specific aspects of social experience, such as how well a concept describes social behaviours (Zahn et al., 2007), or the degree to which concepts relate to the relationship between self and others (Crutch et al., 2012). To further progress theory, the field would benefit from a clearer working definition of socialness. To this end, we conducted a large-scale rating study in which we provided participants with an inclusive definition of socialness and asked them to collectively rate over 8,000 English words. Our findings confirmed that these ratings have good reliability and capture aspects of word meaning that are distinct from those measured via other semantic variables like valence and concreteness. Using these ratings, we also examined whether there were behavioural effects of socialness in lexical and semantic tasks. We hypothesized that if socialness was an important dimension of word meaning, then it should have effects like those of other semantic richness dimensions (Pexman, 2012), wherein higher levels of socialness are associated with facilitated responding. Using lexical and semantic response data available from megastudies, we found that there were faciliatory effects of socialness in visual lexical decision (Balota et al., 2007), auditory lexical decision (Goh et al., 2020), and semantic decision tasks (Pexman et al., 2017).

Finally, we combined the socialness ratings data with those from other lexical-semantic norms (the Lancaster Sensorimotor Norms (Lynott et al., 2020), valence extremity and arousal (Warriner et al., 2013); word frequency (Brysbaert & New, 2009), semantic diversity (Hoffman et al., 2013), average neighborhood similarity (Shaoul & Westbury, 2010), orthographic/phonologic Levenshtein distance (Yarkoni et al., 2008), age of acquisition (Dale & O'Rourke, 1981; Brysbaert & Biemiller, 2017), and conducted a factor analysis to determine where socialness fits in a broader semantic space. Results suggest that socialness is related to dimensions of auditory experience and mouth motor action, and somewhat distinct from factors related to interoception, emotion, visual experience, haptic experience, and distributional language properties. We interpret these results as evidence that socialness, even broadly defined, is a dimension of word meaning that should be considered in semantic theories, and fits best with multimodal accounts (e.g., Borghi et al., 2019; Lambon Ralph et al., 2017; Patterson et al., 2007), in which multiple dimensions contribute flexibly to retrieval of word meaning.

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Poster Session 2.1

Title: Semantic properties of English nominal pluralization: Insights from word embeddings
Authors: Elnaz Shafaei-Bajestan, Peter Uhrig and R. Harald Baayen

How can we conceptualize the meaning of English nominal pluralization? For long, it has been assumed that English plural formation has a constant abstract meaning [+PLURAL]. In distributional semantics, pluralization has been approached using proportional analogies, as in king : kings :: queen : queens. One method for implementing proportional analogy for plurals, 3CosAvg, was proposed by Drozd et al. (2016) (see also Westbury and Hollis, 2019). They operationalize pluralization by utilizing a fixed vector that we refer to as the average shift vector. This vector is defined as the difference vector between the average of all plural vectors and the average of all singular vectors. The shift vector is added to the singular vector to obtain its plural vector.

Based on 11,749 singular-plural noun pairs in the NewsScape English Corpus (Uhrig, 2018), we demonstrate a fundamental problem with this approach to pluralization. Us- ing 300-dimensional word2vec embeddings (Mikolov et al., 2013), we computed for each singular-plural pair an individual shift vector. Figure 1 visualizes the scatter of the in- dividual shift vectors (as dots) using the t-SNE algorithm (van der Maaten and Hinton, 2008). Colors correspond to the semantic labels of the base word in WordNet (Fellbaum, 1998). Three semantic groups are highlighted for illustration. Clearly, individual shift vectors are organized in semantic clusters. In other words, a word's shift vector depends on the semantic class of its lexeme. For instance, pluralization is similar for animal nouns (red) and is different from that of person nouns (blue) and the more abstract communication nouns (green) such as language. The average shift vector as used in 3CosAvg (marked with a red cross) is located near the origin of this space and fails to do justice to the intricacies of pluralization in English. We, therefore, propose a new model for pluralization, CosClassAvg, that operates with class-specific average shift vectors (marked with arrows in the figure). The plural vector for cows is thus obtained by adding the average shift vector for animals to the singular vector of cow. In our presentation, we will discuss evidence that this method improves the quality of predicted (conceptualized) plural vectors.

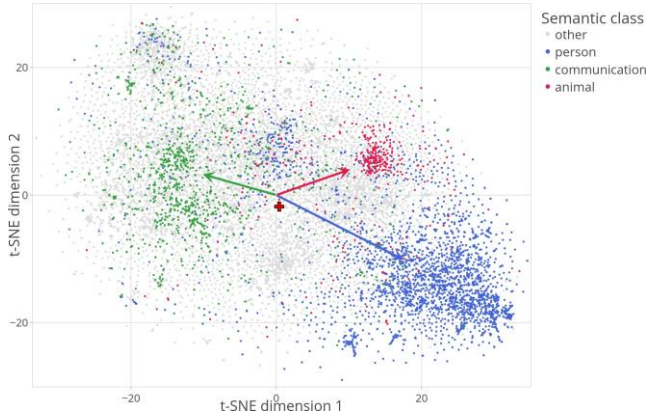

Figure 1: Projection of shift vectors onto a 2D plane using t-SNE reveals semantic clusters.

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Title: The more you know: Age-related facilitation in the production of irregular morphology

Authors: Jana Reifegerste and Aleksandra Trifonova

Over the last few decades, language processing in aging has received increasing attention, though most research has focused on the lexicon and syntax, with fewer studies examining effects of aging on morphology. Most of this still sparse evidence comes from priming studies, which suggest selective effects of aging on inflectional processing: while priming effects for irregular/lexically-conditioned inflections decline with increasing age, regular inflections appear to be unaffected by aging, with stable priming effects across the adult lifespan (Clahsen & Reifegerste, 2017; Reifegerste & Clahsen, 2017; Royle, Steinhauer, Dessureault, Herbay, & Brambati, 2019), in line with dual-route models of morphological processing (storage-based vs rule-based accounts; cf. Clahsen, 1999; Pinker & Ullman, 2002).

The present study extends this work to language production, which has thus far largely been ignored within the field of morphology in aging. Specifically, we were interested in the extent to which frequency effects might be affected by aging. On the one hand, it is conceivable that declining cognitive abilities (e.g., memory) may impede storage-based processing of irregular forms, perhaps especially for lower-frequency forms with particularly weak associative links between stem and stored inflected form. On the other hand, lifelong experience with inflections may confer age-related benefits for the processing of irregular forms, due to cumulative frequency effects, which should provide particular support for low-frequency forms.

In a speeded elicitation task, 157 German native speakers (18-91 years) produced German noun plurals from their singular form. While an "open class" of lexically-unconditioned German plural inflections are posited to follow a default rule (e.g., Zebra-Zebras, 'zebra(s)'), the plural affix of a "closed class" of lexically-conditioned non-default plurals may be either phonologically predictable from the singular form (Lampe-Lampen, 'lamp(s)') or entirely unpredictable (Kartoffel-Kartoffeln, 'potato(es)') (Penke & Krause, 2002; Sonnenstuhl & Huth, 2002). 120 nouns from these three plural types (default, non-default predictable, non-default non-predictable) were matched on frequency and length measures, as well as age-of-acquisition. We alsocollected data on various cognitive abilities and sociodemographic factors.

Mixed-effects regressions revealed different trajectories for RTs for default versus (predictable and non-predictable) non-default plurals. Default plurals did not show frequency effects (in line with their presumed combinatorial nature), and were not affected by age. Non- default plurals, however, yielded frequency effects (suggestive of stored representations of these forms in the mental lexicon), the size of which significantly decreased with increasing age. This decrease in frequency-effect size was due to age-related increases in the speed with which participants produced especially low-frequency non-default plurals, while the production of high- frequency forms was less affected by age. Exploratory analyses revealed that the effect of age on production latencies for low-frequency non-default forms was mediated by participants' performance at the Author Recognition Test (Stanovich & West, 1989; German version: Grolig, Tiffin-Richards, & Schroeder, 2020), a measure of print exposure and reading habits. No such effects were found for high-frequency forms or for default plurals.

Our results support previous findings of a dissociation in how aging affects regular versus irregular morphology. We found stable processing of regular morphology across the lifespan, in line with prior research. Strikingly, however, participants became faster with age at producing

especially low-frequency non-default plurals. We suggest that decades of additional language input provide older adults with greater cumulative (i.e., lifespan) frequency of stored inflections, which confers particular benefits at the low end of the frequency continuum.

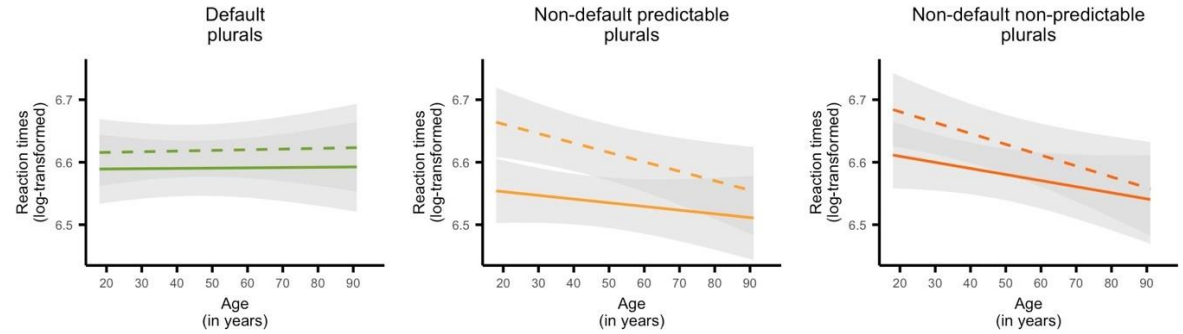

Figure 1: Log-transformed RTs as a function of age and target form frequency for the three plural types. Error bands correspond to standard errors of the mean. Continuous lines represent high-frequency plural forms; dashed lines represent low-frequency plural forms.

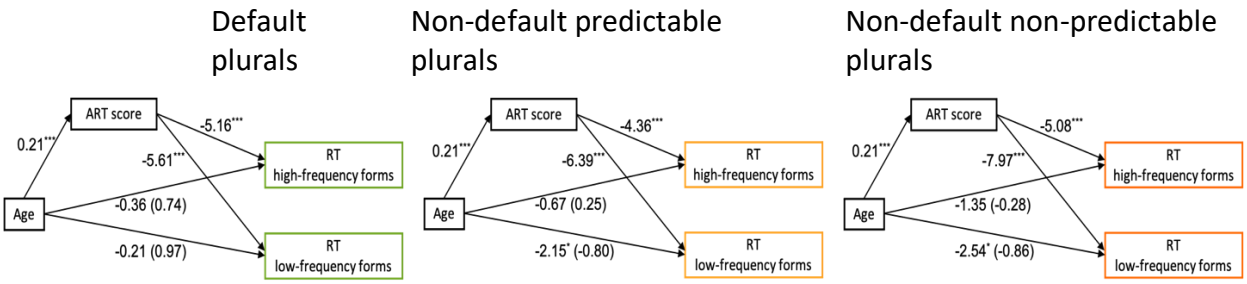

Figure 2: The effects of Age on RTs for low-frequency non-default predictable and low-frequency non-default non- predictable forms were fully mediated via participants' Author Recognition Test (ART) scores.

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Title: Orthographic representation of words in the mental lexicon: exposure to print affects performance in spelling recognition task

Authors: Daria Chernova and Polina Maximova

Introduction

Spelling errors can be considered as a result of a word's weak orthographic representation in mental lexicon, see the Lexical Quality Hypothesis (Perfetti&Hart2007). Rahmanian and Kuperman (2019) suggested that frequent alternative spellings can affect visual recognition of correctly spelled words as they increase entropy in mental lexicon and blur orthographic representations. High entropy results in slower word recognition, even if spelled correctly. Print exposure has been shown to affect orthographic processing skills (Stanovich, West 1989) as well as word recognition (Chateu, Jared, 2000). However, the question whether the level of print exposure affects the robustness of the word in mental lexicon still remains open.

Material

We selected 65 words which are frequently misspelled according to General Internet Corpus of Russian (http://www.webcorpora.ru/), which includes unedited texts from social media (20 billion words). For each word we defined the frequency of the correct spelling, the frequency of the incorrect spelling, and the uncertainty between spelling variants using an information-theoretic measure of entropy (see Rahmanian and Kuperman 2019). We used a spelling decision task: half of the words were spelt correctly, another half was misspelt and vice versa in the second experimental list.

Participants and Procedure

75 native speakers of Russian (aged 18-65, 39 female) took part in the study. The experiment was conducted online using PCIbex (https://farm.pcibex.net/). The participants were presented isolated words and had to decide whether the spelling is correct or not. Accuracy and reaction times were registered. Also each participant were given an Author Recognition Test (Stanovich, West 1989), adapted for Russian readers.

Results and discussion

As for answer accuracy, is affected both by entropy (β=-2.5, Z=-4.9, $p<0.001$) and the print exposure of the participant (β =0.02, Z=2.99, p=0.003). However, these factors do not interact (β=-0.001, Z=0.16, p=0.8). Answer accuracy is also affected on how the word has been presented – it is easier to state there is no mistake in a correct word than to find a mistake in an incorrect one (β =1.2, Z=14.4, $p < 0.001$)

The reaction time was only affected by how the word has been presented (β =-114.9, SE=25.343, t= -4.537, $p<0.001$). Other factors were not significant.

Our data gives evidence that frequent misspelling blurs representation of the word in mental lexicon, making it difficult to make a spelling decision. Experienced readers have more robust orthographic representations which is in line with findings that print exposure improves spelling abilities. At the same time, print exposure does not speed up the decision – the response time is only affected by the frequency of the presented variant.

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Title: The search for matching nouns: parafoveal processing of gender-specific German articles
Authors: Laura Schwalm and Ralph Radach

Current research has suggested that some syntactic information such as word class can be processed parafoveally during reading. Languages like German, where gender information is explicitly coded with articles, allow examining whether early syntactic cueing within noun phrases can facilitate subsequent word processing during dynamic reading. This issue has not been part of ongoing debates in the literature on syntactic priming (e.g. Tooley & Traxler, 2010) and we are not aware of any research that has examined the effect of an article's syntactic fit on the processing of the subsequent noun.

Two experiments were designed in which either the article (experiment1) or the noun (experiment 2) was manipulated in the parafoveal, manipulating the syntactic fit. We asked participants to read German sentences with nominal phrases like the following: „Der neue Mitarbeiter gibt diefem/dasneut Sacheneut lieber an einen erfahrenen Kollegen weiter."or "Der neugierige Gorilla fast diefem Wangefem/Deckefem/Bodenmasc immer wieder mit großem Vergnügen an".

An invisible boundary before the article served to create a mismatch so that one part of the nominal phrase could be incorrect with respect to grammatical gender of the other part, while maintaining consistency with prior context. In experiment 1 the frequency of the noun was additionally varied. It was expected that the mismatch effect would be more pronounced for higher frequency nouns.

Results of the two experiments indicated a substantial elevation of viewing times on both parts of the noun phrase in the case of a parafoveal syntactic mismatch. Unexpectedly, this effect was independent of noun frequency and far vs. near launch distance of the incoming saccade. Moreover, in experiment 1 the article was fixated more often when a syntactic mismatch was presented in the parafovea. These results provide direct and compelling evidence of parafoveal syntactic processing. Based on the early time-course of the effect, we suggest that that skilled readers of German regularly utilize grammatical gender information for pre-activation of matching nouns in the mental lexicon.

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Title: Asymmetries in the processing of negation: A study in aphasia

Authors: Sam Alxatib, Mira Goral, Virginia Jaichenco, Gary Libben and María Elina Sánchez

Introduction: Negation is important because its processing recruits syntactic, morphological, and lexical aspects of language. It has been reported in the literature on aphasia that negation presents difficulties to some, but not all, persons with aphasia (PWA), and that the difficulties are typically ones of production rather than comprehension. For example, in a sentence anagram task, PWA had more errors in negative than in affirmative sentences (Fyndanis et al., 2006; Rispens et al., 2001), but in a sentence elicitation task, PWA had little difficulty producing the negations of affirmative prompts (Albustanji et al., 2013). We are not aware of studies that compare PWA's ability to negate affirmative prompts to their ability to derive affirmatives from negative prompts. We aim to use this comparison to further our understanding of how negation is processed, using insights from the performance of PWA.

Method: Participants: Fourteen people participated in the study. Six PWA (three Spanish speakers; three English speakers) and eight neurologically-healthy people. All participants were 30-65 years old with ≥12 years of schooling. Procedure and materials: We designed two tasks: (1) Repetition task: a sentence was said aloud and the participants had to repeat it verbatim. E.g. prompt: The aunt is reading; target: The aunt is reading; (2) Say-the-Opposite task: a sentence is said aloud and the participants must produce the opposite sentence. E.g. prompt: The aunt is reading; target: The aunt is not reading. The tasks included sentences in six conditions that vary in (a) verbal aspect, (b) verb phrase complexity, and (c) type of negation (particle vs. adverbial/quantificational). For each condition, 16 stimuli were created (eight affirmative and eight negative), so each task had a total of 96 items.

Results: All our neurologically-healthy participants performed at ceiling. Five of the six PWA showed greater difficulty in the Say-the-Opposite task than in the Repetition task. Four of these five demonstrated greater difficulty converting negative prompts to affirmative than converting affirmative to negative (see Figure 1). The participants also had greater difficulty with the adverbial/quantifier negation prompts than with particle negation. The difficulty in all conditions showed the same directional asymmetry.

Discussion: We take our findings to suggest that PWA find greater difficulty deriving the affirmatives of negative sentences than the reverse, despite the apparent similarity of the two conditions: in one condition the task involves omitting the negation particle (or replacing the negative adverb with its antonym), while in the other it involves adding negation (or replacing the positive adverb with its antonym). We discuss the implications of these findings in the context of earlier work on the comprehension and production of negation.

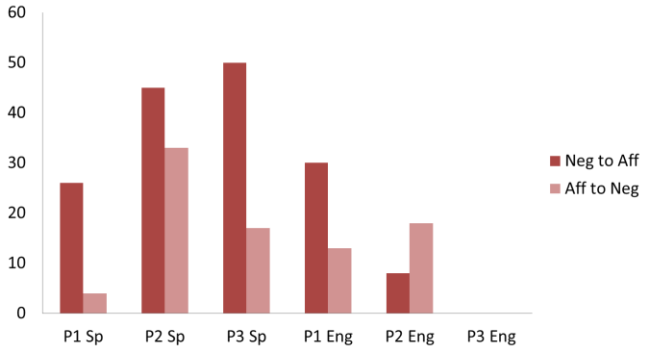

Figure 1. Number of errors in the Say-the-Opposite task of six PWA (Sp=Spanish; Eng=English; Neg=Negative; Aff=Affirmative)

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Title: Is there hip or a pie in hippie? The influence of phonological transparency on the (pseudo)morphological decomposition of pseudo-compound words

Authors: Juana Park, Christina Gagné and Thomas Spalding

English compound words (e.g., birdhouse) consist of two unbound morphemes. Pseudo-compound words, on the other hand, are words that look like compound words but are, in fact, etymologically monomorphemic (e.g., the pseudo-compound word hippie has the words hip and pie embedded, but they do not function as morphemes inside that word). In this project, we examine phonological transparency, which is the degree to which the pronunciation of each pseudo-constituent is preserved in pronunciation of the whole word. For instance, the pseudo-compound word hippie would be considered phonologically transparent-opaque because the pronunciation of hip (/hɪp/) is preserved in the
pronunciation of hippie (/ˈhɪpi/), whereas the pronunciation of pie (/paɪ/) is lost in hippie. The goal of this study was to examine whether the pronunciation of the two pseudo-constituents influences the production of pseudo-compound words in a typing task, and, in particular, whether the pronunciation affects typing at the pseudo-constituent boundary. We manipulated the phonological transparency of the first and second constituent. We found that there were significantly elevated inter-letter typing times across the pseudo-constituent boundary in pseudo-compound words with with fully phonologically transparent pseudo-constituents. There was no such pseudo-constituent boundary effect in items with phonologically opaque pseudo-constituents. Importantly, the differences were largely driven by typing times at the end of the first pseudo-constituent. When the pseudo-compound was phonologically transparent, there was a pseudo-boundary effect similar to (though smaller than) that usually found with compound words, but phonological opacity appears to remove that effect.

Title: On the relation of grammar and lexicon: Evidence from Asymmetric Priming of Participles and Homonymous Inflected Verb Forms in Native and Non-native German

Authors: Denisa Bordag, Andreas Opitz and Alberto Furgoni

Research Questions: Is lexical access to verbs different depending on the degree of their grammatical specification (i.e., the number of features they express)? Does the L1 and L2 grammar processing differ at the abstraction level on which the processing systems operate?

Research Context: Experimental evidence indicates that the amount of grammatical information subsumed by inflected forms is reflected in priming asymmetries between morphosyntactically more vs. less specific forms. The studies focused on German adjective declension and irregular stem alternations and revealed that forms specified by more grammatical features are harder to retrieve and process, but they are better primes for other, less specific forms (Bosch & Clahsen, 2016; Clahsen et al. 2001; Opitz et al, 2013). Various proposals have been suggested to account for diverging priming patterns, e.g., that L2 learners have problems with building generalized, abstract paradigms that consist of a set of rules or rule-like operations to map grammatical functions to affixes (e.g., in English X → Xed, +past) (Pinker 2009; Veríssimo et al. 2018).

The present study: In two overt visual priming experiments L1 speakers (N=48) and advanced L2 learners (N=48) of German (L1 Czech) were presented with short phrases consisting of syntactically disambiguating contexts followed by a regular verb form that was either finite (3rd p. sg.) or non-finite (past participle, i.e., containing less morphosyntactic features). The verb forms, at which presentation participants made grammatical judgement over the whole phrase, were form- identical in both uses (eliminating form-related confounds, e.g., form frequency or overlap). Prime and target phrases were created by completely crossing whether they contained an inflected verb or a participle and whether they contained the same lexical verb or not:

Examples with lexical repetition					*Examples without lexical repetition*				
Prime			**Target**		**Prime**			**Target**	
er	BESUCHT	→	er	BESUCHT	sie	VERFOLGT	→	er	BESUCHT
er hat	BESUCHT	→	er	BESUCHT	sie hat	VERFOLGT	→	er	BESUCHT
er hat	BESUCHT	→	er hat	BESUCHT	sie hat	VERFOLGT	→	er hat	BESUCHT
er	BESUCHT	→	er hat	BESUCHT	sie	VERFOLGT	→	er hat	BESUCHT
('he visits / he has visited')					('she follows / she has followed')				

Results & Conclusions: We observed priming between morphosyntactic feature sets using lexically unconditioned regular verb forms with different degrees of morphosyntactic specification. The more specific 3rd p. sg. forms fully primed the less specific participle forms, but the less specific participle forms with a smaller morphosyntactic feature set did not fully prime the more specific inflected forms. This finding is in line with previous research examining adjective declension and lexically conditioned relationships between irregular verb stems. However, in L2 this (less pronounced) pattern was restricted to the condition in which the lexical verb was repeated. In the condition where only the morphosyntactic configuration (i.e., the function of the forms) was repeated, no indication for better priming ability of the morphosyntactically more specific forms could be observed. L2 processing thus seems more idiosyncratic in the sense that it is more tied to individual lexical items. We found no evidence that advanced L2 learners would engage in morphosyntactic processing on a more abstract level

of generalized paradigms. Results are discussed against the background of different theoretical frameworks of L1 vs. L2 processing (e.g., Shallow Structure Hypothesis, Clahsen & Felser 2006, 2018; Declarative Procedural Model, Ullman 2004, 2005).

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Title: Mental representation of word family structure: The status of infinitives and conversion nouns in German

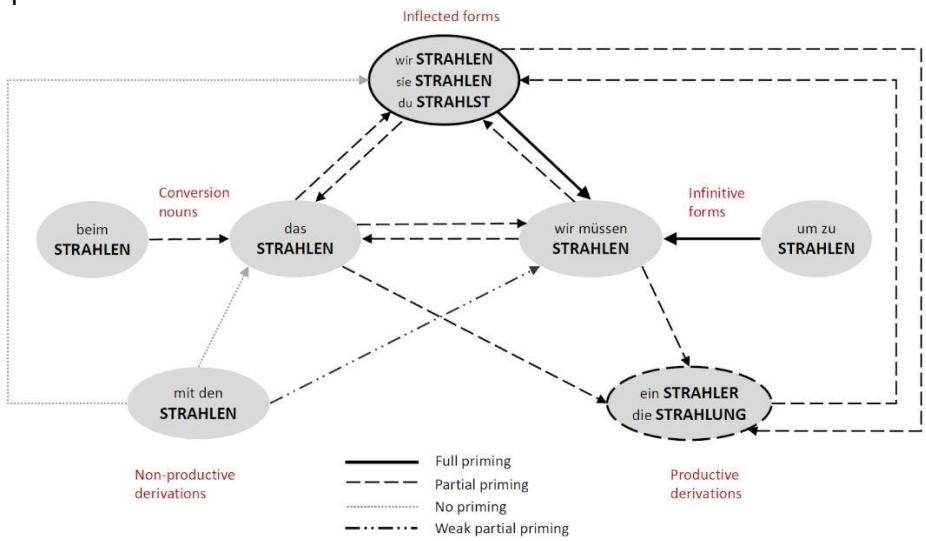
Authors: Denisa Bordag, Andreas Opitz and Alberto Furgoni

The status of infinitives and conversion nouns as either inflection or derivation is controversial, as well as their word class assignment. According to some approaches, they belong to the class of so- called non-finites that exists in addition to the lexical classes of nouns and verbs (e.g., Haspelmath, 1996; see Ylikoski, 2003 for an overview). We investigated the mental representation of these forms by exploring their mutual relationship and the relationship between them and other members of their word family. A word family comprises morphologically related forms that share the same root and has been rarely a topic of direct exploration (but see e.g., Van de Vijver & Baer-Henney, 2019). Previous priming research suggested that the two forms might form a special word class (Bordag & Opitz, 2021). However, the relationship between the forms was tested only in one priming direction, though asymmetric priming signaling that word family members may be organized along their morphosyntactic relation was reported in number of recent studies both in L1 and (though non-native) in L2 (Krause & al., 2015; Bosch & Clahsen, 2016; Bosch, Krause, & Leminen, 2017; Bosch, Versíssimo, & Clahsen 2019).

In the present study, German native speakers and proficient German learners with Czech as L1 participated in six overt priming experiments. All primes and targets were integrated into short syntactic contexts that enabled morphosyntactic disambiguation of homonymous forms. Judgement about the grammaticality of the whole phase was made only on the critical word. The experiments investigated the relationship between infinitives (e.g., strahlen - to radiate) and conversion nouns (das Strahlen - the radiating) that were used either as primes or targets as well as their relationship with other formally identical members of their word family (e.g., wir strahlen- we radiate, er mit den zwei Strahlen - with the two rays) or with regular nominal derivation (derivational suffixes: -er: Strahler – radiator and –ung: Strahlung - radiation). Different priming conditions for one target form were created and their relation systematically manipulated yielding different priming conditions.

Based on the results summarized in the figure, we could conclude that the two non-finite forms differ in their relations to other members of a word family and do not constitute a separate class of non-finites as suggested in previous literature.

German infinitives manifest a unique status in the word family and seem to be closely related to finite verbal forms; conversion nouns exhibit the same properties as regular nominal derivations within the same word family. No evidence for significant differences in the mental representation of the examined forms was found between native and advanced L2 speakers.



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Title: Lexical Access: Sentence Context Effect in Embedded Words

Authors: Fernando Sabatini

Embedded words (Vroomen & De Gelder, 1997; words within words for Van Alphen & Van Berkum, 2010) are spurious words — i.e. not intended by the speaker — that are embedded in longer words and have no semantic relationship to them: e.g. pain in champaign (final embedding). Two interesting questions for psycholinguists are (i) whether these words reach lexical activation when one listens to the carrier word, and (ii) whether their meanings are taken into account by the listener when making sense of an utterance that contains the carrier word. This phenomenon brings an opportunity for us to better understand the dynamics of word segmentation in spoken speech; moreover, it allows us to test modelos of lexical access, since the cohort model (Marslen-Wilson, 1987), for example, predicts that final embeddings would not join the competition for lexical access. Thereby, the subject has been addressed by different methods (cf. Vroomen & De Gelder, 1997 for a priming experiment; van Alphen & van Berkum, 2010 for an EEG/N400 approach). However, there is still an open debate due to inconsistency between studies: some have reported semantic priming effects elicited by embedded words (Isel e Bacri, 1999; Luce e Cluff, 1998; Vroomen e de Gelder, 1997; Shillcock, 1990), while others have found none (Norris et al., 2006; Gow e Gordon, 1995) or even inhibitory priming effects (Shatzman, 2006; Marslen-Wilson et al., 1994). I argue that two methodological questions may have a role in this inconsistency, namely (a) whether the carrier word is tested alone or in a sentence; (b) the specific Stimulus Onset Asynchrony (SOA) between prime and target. When the SOA is set too high (>400 ms), the prime segment may have already been inhibited when the target is presented, hence no effect would be noticed. Predictability, in turn, is a Sentence Context Effect (SCE) that enhances the activation of the carrier word (van Alphen & van Berkum, 2012). A question is whether it might do that strongly enough to restrain the activation of embedded words. Thus, in an ongoing study I aim to disentangle the issue: I have designed a cross-modal associative priming experiment, in which a Brazilian-Portuguese carrier word containing a final embedded word (e.g. fé [faith] in café [coffee]) is put in the final position of a spoken sentence as prime to a visual target. I compare priming effects (associated vs. unrelated prime-targets) while manipulating four conditions: (i) SOA = offset (0 ms); (ii) SOA = 500 ms; (iii) highly predictable context (evaluated by a cloze test[1]) in favor of the carrier; (iv) neutral context. I aim to assess (1) whether SCEs might favor a carrier word strongly enough to inhibit any activation of an embedded word, and (2) whether, if indeed activated, embedded words may be rapidly inhibited. In this presentation I will discuss the results and their contribution to Language Processing and Lexical Access studies.

[1] For a Sentence Context Effect study using a cloze test for Predictability evaluation, cf. Souza Filho (2021).

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Title: The family size effect in reading and hearing

Authors: Hanno Maximilian Müller, Louis ten Bosch and Mirjam Ernestus

A word's family size (FS) is the type count of all morphologically complex words in which a given word appears as a constituent (Schreuder & Baayen, 1997). For instance, the family of 'play' includes words like 'playful', 'replay', and 'playground'. Words with bigger FSs elicit shorter response times (RT) in visual lexical decision (LD; e.g. Baayen et al., 1997; Kuperman et al., 2009), which is usually associated with how semantic concepts are organized in the mental lexicon (e.g. Bertram et al., 2000; Jong, 2002). For auditory LD, reported FS effects are less clear: facilitative (Wurm et al., 2006; Winther Balling & Baayen, 2008), absent (Baayen et al., 2007), or inhibitory (Winther Balling & Baayen, 2012). The latter study finds a facilitative effect for family members that are onset-aligned with the target word indicating that differences between the visual and the auditory FS effect might be due to systematic differences between written and spoken word recognition: Written words likely are perceived at once, whereas spoken words are perceived incrementally during the acoustic signal's unfolding in time.

In this study, because of the conflicting findings on the auditory FS effect, we examined the effect in more detail using different FS definitions and we analyzed the interaction between the words' morphological structures and the FS effect. For analyzing this interaction, a large-scale data set is required, which we have. In addition, we compared visual and auditory word recognition to rule out that differences between the two modalities are due to methodological differences.

Using generalized additive models (Wood, 2017), we predicted RTs of 20 subjects to 1,932 unique auditory words from the Biggest Auditory LD Database Yet (BALDEY; Ernestus & Cutler, 2015) and of 39 subject to 9,472 unique written words from the Dutch Lexicon Project (DLP; Keuleers et al., 2010). Our baseline model included the most prominent predictors except FS that were shown to predict visual and auditory LD RTs in previous studies.

We tested whether including FS (e.g., Schreuder & Baayen, 1997) or onset-aligned FS (Winther Balling & Baayen, 2012) as predictor improved the baseline in terms of AIC. In addition, we defined semantic FS as the type count of family members weighted by their cosine similarity with the word based on a Dutch word2vec model (Nieuwenhuijse, 2018) and onset-aligned semantic FS as the onset-aligned family members weighted by their cosine similarity. We examined the interaction between the respective predictors and the morphological structure of the words, which were either simplex, consisted of a prefix and a stem, or a stem and a suffix.

The analysis of both the visual and auditory data show that each FS predictor improves the model fit. The two data sets differ in which FS yields the greatest model improvement. For the visual data, semantic FS provides the best fit: the semantic FS has a facilitative effect for all words but the effect size differs per structure. For the auditory data, onset-aligned FS provides the best fit and yields a facilitative effect. However, if the interaction with morphological structure is included in the model, FS and semantic FS return a better fit than onset-aligned FS with a facilitative effect for simplex and an inhibitory effect for prefixed words.

Our results indicate that FS not only plays a role in visual, but also in auditory LD, whereby the effect of a given word's morphological structure varies across the modalities. We think these differences emerge from systematic differences between reading and hearing words. In visual LD, words are recognized more quickly the larger their morphological family, and family members contribute more to this effect the more semantically similar they are to the target word. In auditory LD, the FS effect is facilitative only for suffixed words. For prefixed words, the effect is

inhibitory, indicating a different processing mechanism for these words.

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Poster Session 2.1

Title: Memory for emojified text: Recollection of emojis with semantically redundant versus inferential functions

Authors: Laurie Beth Feldman, Andriana L. Christofalos and Heather Sheridan

Emojis can reinforce the sentence context in which they occur in different ways. Most frequently investigated in laboratory experiments are social affective elaboration (These cookies are delicious 🙂) and emoji-word synonyms (I love spring flowers 🌹). By comparison with synonym (Cohn et al., 2018; Schleffler et al., 2022; Weissman, 2019) and social affective functions (Garcia et al., 2022; Weissman & Tanner, 2018), the role of emojis in inferential processes has received much less attention. We report the results of an online recognition memory task that investigates whether emoji function within a short passage affects recognition accuracy and false alarm rates. Our primary focus is a comparison of recognition memory for emojis that facilitate inference 🌵 versus those that are redundant with a target word 🧱 in sentences devoid of word associations such as:

> *Harold cultivated a beautiful garden in the sand around his home. He worried that his toddler would hurt himself on the plant near the brick retaining wall if he climbed on it.*

We compare recognition of emojis from sixty two-sentence passages, some of which were modified from Virtue and Joss (2017). Each passage was paired with three non-affect, object emojis: 1) an emoji consistent with the inference, 2) an emoji consistent with the meaning of a target word within the passage, and 3) an emoji that was irrelevant to the passage (incongruent emoji). Participants saw each passage once and no emoji appeared in more than one passage.

Experimental evidence suggests that emojis that function as synonyms of a target word from a passage can facilitate text comprehension (Daniel & Camp, 2020) while effects of eye-tracking measures on non-face emojis that are positioned at the end of sentences vary according to how close the synonymous target word is positioned to the emoji (Barach et al., 2021). Therefore, in the present study, we contrast recognition by function for emojis in sentence initial and sentence final positions. While an emoji coordinated with an upcoming sentence admittedly is unnah1ral (Kwon, 2022), emoji influence across sentences has not been systematically examined. Effects of emoji function that vary with its position in a text would be consistent with the timing of gestures relative to speech so as to enhance the focus on some elements over others (Overoye & Wilson, 2020).

Data collection is ongoing (N=30). Preliminary results indicate that recognition accuracy for emojis that function as synonyms is numerically higher but not statistically significantly different than recognition accuracy for emojis consistent with an inference in the sentence final emoji conditions. False recognition analyses for passage final emojis as well as comparisons with passage initial emojis are planned.

Our novel working hypothesis is that the emoji-text relation for object emojis may influence processing. The focus of the initial phase of our program of research is on how emoji-text relation influences recognition memory. In the longer-term, we plan to compare eye-tracking measures for the same emoji conditions to study the time course of comprehension.

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Title: 'Minds' in 'Homer'
Author: Boban Dedovic

"My child, why do you weep? What grief has come upon your *phrenes* (φρένες)? Speak—conceal not in *noos* (νόος) in order that we both may know," so speaks Achilles' mother Thetis as the fierce warrior weeps tears of wrath on the beaches of Troy (*Iliad* 1.362–63). To be sure, *noos* likely translates as "mind" in English in the above passage. However, Homer's *Iliad* and *Odyssey* include a total of eight such words that may be rendered as "mind," "heart," or "spirit": *noos* (νόος), *thymos* (θυμός), *psykhe* (ψυχή), *phrenes* (φρένες), *prapides* (πρᾰπῐ́δες), *kardia* (κᾰρδῐ́ᾱ), *kradie* (κρᾰδῐ́η), *ker* (κῆρ), and *etor* (ἦτορ). This complicated situation with Greek translations of "mind" is at the heart of this study's empirical investigation. To wit, what is "mind" in the *Iliad* compared to the *Odyssey*? The present investigation sought to quantify and compare the use of mental language in the Homeric epics by means of computational linguistics. Prior scholarly investigations have been mostly qualitative; the few quantitative studies conducted utilized miniscule sample sizes of English translations. Two studies were conducted. Seventeen translators who translated both the *Iliad* and *Odyssey* into English were selected (within-subjects design). The texts were sanitized and compiled for lexical frequency analyses in *Voyant*, a digital linguistic analysis tool. Study-1 compared how often mental language terms appeared in both works. Results showed that total word density of mental language increased significantly from the *Iliad* to the *Odyssey* in both English translations as well as in the original Greek version. Study-2 compiled an English glossary of mental language terms and counted the frequencies for the thirty-four total works. A paired-samples *t*-test was conducted to compare the mean mental language densities of both works across seventeen translators. There was a significant difference in the mean densities for the *Iliad* (M = 68.2, SD = 8.9) and *Odyssey* (M = 91.9, SD = 11.6) conditions; $t(16) = -17.798$, $N = 17$, $p < .001$, $d = -4.317$. Further correlational tests as well as ANCOVA were conducted in order to determine if various factors could explain the large effect size. No significant results were observed or relevant. All hypotheses were supported. These data suggest that the *Odyssey* contains much more mental language than the *Iliad.* Implications and limitations are discussed.

Keywords: *Iliad*, *Odyssey*, Homer, mental language, psycholinguistics, mind, computational linguistics

Title: Mental Lexicon in Reading Comprehension Processes

Authors: Tami Sabag Shushan and Tami Katzir

Vocabulary knowledge has been shown to have a very strong effect on reading comprehension abilities (Pearson, Palincsar, Biancarosa, & Berman, 2020). The considerable contribution of vocabulary knowledge to reading comprehension led to the development of an academic word list and of various tools for evaluating this knowledge. However, vocabulary tests appear to have been launched with poor and insufficient validity evidence, and with insufficient theory or guidance on how to select words for the test (Pearson, Hiebert, & Kamil, 2007). Another gap is related to word types. Existing assessment tests see vocabulary as a whole unit with no distinction between word types and with no attention to emotion vocabulary. Emotion words are not found in vocabulary assessment tests and in the word list. The distinctions between emotion and non-emotion words are supported by broad theoretical justifications, and they include among others evident in developmental perspective, emotion words are acquired at later ages, usually after entering school (Ravid & Egoz-Liebstein, 2012). Given these differences, it is important to study the role of emotion words in reading comprehension as well, since it may diverge from that of other types of words.

In the current study, we first describe the development of a novel vocabulary assessment in Hebrew –Herut which includes both emotion words (e.g., pride, guilt) versus non-emotion words, (e.g. progression, assumption). This assessment and is curriculum-based and is based on a theoretical model (Scherer, 2005). The first aim will be to validate the Herut measure. The second aim will be to assess the contribution of vocabulary measures and words types (emotion and non-emotion words) to predicting reading comprehension ability by using a hierarchical regression analysis.

To answer these research questions, the research participants consisted of 1,333 Hebrew-speaking students from 21 elementary schools in the fourth and fifth grades. The findings show significant positive correlation between the Herut measure and the Elul vocabulary measure

($r = .592$, $p < 0.001$). Positive correlations were also found between the Herut measure, reading fluency, and reading comprehension (all $p < 0.001$). It's also found that both types of vocabulary knowledge made significant independent contributions to reading comprehension, and the contribution of emotion words was slightly larger than that of non-emotion words. Finally, the Herut measure was found to be more predictive of reading comprehension than a general vocabulary measure in Hebrew.

This study illuminates a new perspective on the importance of emotion words not only for social behavioral aspects but also for literacy aspects. These findings have very important theoretical and applied implications. Developing these elementary school skills may promote students' reading comprehension abilities.

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Title: Why do words disappear from a language? An investigation of the connection between language processing and language evolution.

Authors: Peter Hendrix and Ching-Chu Sun

Words do not exist in isolation, they exist in a community of words that together form a language. Within a language, words compete for existence (Petersen et al., 2012). Some words thrive in this competitive environment and establish or maintain a firm position in a language. Other words succumb to systemic pressure and gradually cease to exist. The competitive position of a word in a language is to a considerable extent determined by circumstances that are extrinsic to the language itself, such as changes in society. Properties of a language and the words within a language, however, have also been shown to influence the direction in which a language develops (Bochkarev et al., 2014). The relation between language evolution and language learning has been a fruitful area of research in this regard. Words that are harder to learn, studies have shown, are more likely to disappear from a language (see e.g., Kirby, 2001; Smith & Kirby, 2008).

The connection between language evolution and language processing, however, has been investigated to a much lesser extent (see Pagel et al., 2007; Turney and Mohammad, 2019, however). The current work investigates this connection through an evaluation of the predictive power of a number of lexical-distributional variables known to influence language processing on lexical extinction in six languages: American English, British English, French, German, Spanish, and Italian. For each language under investigation, we extracted all words with a frequency of at least 0.2 per million in the 1800s – the first decade for which data are available - from the Google books n-gram corpus (Brants & Franz, 2006). We then established if a word became extinct by the 2000s and – if so – in which decade it did.

We conducted a binomial linear regression analysis of the data, using the lexical status of the wording the 2000s (extinct or non-extinct) as the dependent variable. Consistent with previous work, the analysis revealed significant effects of word frequency (cf. Pagel et al., 2007) and word length (cf. Turney and Mohammad, 2019). More frequent and shorter were words less likely to disappear from a language as compared to less frequent and longer words. We furthermore observed novel effects of orthographic and semantic neighborhood density, as well as of orthography-to-semantics consistency (Marelli et al., 2015). Across languages, words that are similar in form to many other words are protected from lexical extinction, as are words with a consistent orthography-to phonology mapping. By contrast, words that are similar in meaning to many other words are more likely to become extinct.

The predictive power of the binomial linear regression model was substantial. Across languages, the average probability that the predicted probability of lexical extinction assigned to a random word that disappeared from a language was higher than the predicted probability of lexical extinction for a random word that did not disappear from that language under 10-fold cross-validation was 0.779 (SD= 0.053). A time-to-event analysis revealed further insight into the temporal development of the predictor effects reported above. Despite the fact that all lexical-distributional variables were calculated on the basis of the data for the 1800s, all predictors had significant effects on the instantaneous probability of lexical extinction until the 2000s. The position of a word in lexical-distributional space in a language in the 1800s thus continued to be predictive for the likelihood that a word disappeared from a language until at least the 2000s.

Taken together, the results reported here suggest that it is possible to make educated guesses about the direction of language change on the basis of lexical-distributional properties of words that are known to influence language processing and to do so for at least two hundred years into the future. The current results thus indicate that a tight connection exists not only between language evolution and language learning, but also between language evolution and language processing (see e.g., Christiansen and Chater, 2016).

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Title: A Database Study on Malay Morphology

Authors: Mirrah Maziyah Mohamed, Melvin J. Yap, Qian Wen Chee and Debra Jared

Morphological processing in visual word recognition has been extensively studied in a few languages, but other languages with interesting morphological systems have received little attention. Share (2008) drew attention to the Anglocentricity of research on reading. He cautioned researchers about relying too heavily on research with English participants to create a universal theory of reading because the spelling-sound correspondences in English are much less transparent than in other alphabetic languages (Seymour et al., 2003). Share's caution could also be applied to the literature on morphological processing because much of that research has been conducted in English (for a review, see Marelli et al., 2020). English differs from other alphabetic languages in that it is a much less morphologically rich language (i.e., it makes less use of affixes) than other languages (e.g., Kelly et al., 2014), and its affixation is not entirely transparent. For example, adding an affix to English words may involve changes to the root spelling (e.g., happy to happiness), pronunciation (e.g., magic to magician), or both (e.g., athlete to athletic). In contrast, agglutinative languages typically have a large number of morphemes per word with few, if any, changes in spelling, phonology, or meaning. Here we examined Malay, an Austronesian language that is agglutinative. Our primary goal was to provide a database that could be used for a wide range of studies on Malay morphology. A secondary goal was to illustrate one way the database could be used to examine morphological processing in Malay.

Our work was influenced by Sánchez-Gutiérrez et al. (2018), who noted that many previous studies of English morphological processing have relied on factorial designs with a limited number of stimuli. To increase the generalizability of findings, they used the English Lexicon Project (ELP, Balota et al., 2007), a database containing lexical information as well as naming and decision latencies for a large set of words. Sánchez-Gutiérrez et al. first segmented approximately 70,000 words in the ELP into morphemes, and then augmented the ELP to include three morphological variables for roots and affixes and three additional morphological variables for affixes. Similarly, here we used the Malay Lexicon Project (MLP, Yap et al., 2010), a database containing lexical information for almost 10,000 words. Like Sánchez-Gutiérrez et al., we segmented 9,339 words in the MLP into morphemes and calculated statistics for the same wide range of morphological variables, and added prefix and suffix consistency measures (i.e., MLP2).

Secondly, we collected lexical decision data for Malay words that had one prefix and one suffix and explored which of the morphological variables predicted decision latencies. We conducted a regularized regression, a strategy recommended by Tomaschek et al. (2018) in analyzing collinear data, and a generalized additive mixed model (GAMM) analysis. Two lexical variables (frequency, length) and three morphological variables (root family size, prefix length, and prefix percentage of more frequent wordsPFMF) emerged as notable predictors of RT. These predictors were then included in a series of GAMM models. We found a facilitatory effect of root family size, an inhibitory effect of prefix length and prefix PFMF on RT. We then explored the interactions between word frequency and several of these predictors. Of particular interest, there was a significant word frequency by root family size interaction in which the effect of root family size is stronger for low frequency words. We hope that this initial work on morphological processing in Malay inspires further research in

Malay and other understudied languages, with the goal of developing a universal theory of morphological processing.

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Title: Do we access the meaning of “car” in “carpet”? Evidence from a word-picture congruency task.

Authors: Kyan Salehi and Roberto G de Almeida

Studies employing a picture-word priming paradigm have shown that picture naming is facilitated when the target picture stands for a constituent (e.g., ROSE; capital letters represent pictures of objects) of a compound distractor word (e.g. rosebud; Zwitserlood et al., 2000). Interestingly, the facilitation effect in picture naming has been found to be smaller when pictures (e.g., BONE) probe the pseudo-constituents of form-related words (e.g., trombone) compared to that of compound distractor words (e.g., hipbone; Dohmes et al., 2004). While these findings are in line with an array of studies that provide support for the morpho-orthographic parsing of (pseudo)complex words (e.g., corn-er, poll-en; Longtin et al., 2003; Beyersmann et al., 2016), the facilitation effect is modulated by whether the distractor word is morphologically complex.

An important case study in the investigation of the nature of the morphological parser involves the comparison between truly compound words and pseudocompounds. While compounds are composed of two or more free morphemes (e.g., doorbell), pseudocompounds superficially embed orthographic sequences that may represent two or more free morphemes while holding no morphological status in the whole word (e.g., carpet). We reasoned that a prelexical parsing mechanism that is blind to lexical semantics should access even the "constituents" of pseudocompounds, during visual word recognition.

The present experiment probed the early moments of conceptual access to compound constituents (e.g., DOOR in doorbell) and pseudocompound constituent-like segments (e.g., C4R in carpet) using a word-picture congruency task. In this task, participants were presented with word and picture targets concomitantly for 100 milliseconds, followed by a backward mask. Their task was to judge whether picture and word were related to each other. The word target consisted either of compounds or pseudocompounds. The pictures, in critical trials, always represented one of the whole word's "constituents" but varied with regards to the constituent position (pictures of either the first or second "constituent"; e.g., DOOR in doorbell; BELT in seatbelt). The final experimental manipulation consisted of projecting the word target either to right hemisphere (left visual field) or left hemisphere (right visual field), with the object picture presented in the opposing visual field. As per the findings from Dohmes et al. (2004), we should expect an advantage in congruency judgements for compounds compared to pseudocompounds.

Accuracy and RTS were analyzed through linear mixed-effects models. The analyses of pilot data (N 8 [note: we expect to run 60 participants by the time of the conference]) did not find main effects of word type and picture-word relation. Moreover, there was a significant interaction between the hemispheric projection of the word target and picture-word relation. Overall, the pictures probing the "first constituent" elicited the most accurate responses when the word target was projected to the left hemisphere (e.g., DOOR + doorbell) and the least accurate responses when the word was projected to the right hemisphere (e.g., doorbell + DOOR). The accuracy to word targets and the pictures of their "second constituent" (e.g., BELT + seatbelt) were slightly higher than 50%, regardless of the word's hemispheric projection.

This experiment allowed us to probe the conceptual representation of compound and pseudocompound "constituents". The preliminary findings suggest that initial "constituents" seem to be accessed at the conceptual level regardless of their true morphological status in the whole word. The advantage for the initial constituent can be accounted for by a prelexical parsing system operating in a left-to-right fashion (akin to a model proposed by Libben, 1994), yielding an initial morpheme-like letter string that quickly accesses its lexical-conceptual representation.

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Title: Verbal Affixation in Russian: Original Priming Study and its Online Replication
Author: Anastasia Chuprina

Background: Suffixed and prefixed words in relation to their base word are commonly recognized as inflectional and derivational relative words correspondingly. In the case with the Slavic language group and Russian verbs specifically, this is not always the case: a suffixed relative migrates to the distinct inflectional paradigm while a prefixed one preserves the base's verbal class (Grammar of Russian, 1980). Semantically though, suffixation is transparent in contrast to the prefixation. I follow the relevant research by testing the priming effect on real word pairs and after two 01thographically modified primes with a replaced letter within one of the morphemes, the effect that is only possible if the decomposition of the stem and affixes takes place (Diependaele et al., 2013). While the majority of morphological studies were performed on a mixture of grammatical classes in contrast to the suggestion that there might be a difference for their mental organization (Frost et al., 2005), I have a controllable homogeneous group of verbs. Even so, as the results suggest, this has not secured a uniform conclusion.

Data and Procedure: I used 39 target base verbs and their suffixed (by *-nu-* and *-va-*) and prefixed (e.g. by *za-*, *o-*, *po-*) relative verbs as primes in three LDT experiments with morphological priming with 60ms prime duration and their online replicas (Forster& Davis, 1984). In Exprt. I (39 people in offline pool and 56 online) were tested real word target-prime pairs, the real target-quasi affixed prime — in Exprt. 2 'Quasi Affixes' (34 and 45), and the real target-quasi stem prime — in Exprt. 3 'Quasi Stems' (25 and 41). The age range of participants is 18-59 years of age (2/3 female).

Results: I used *gam* method (Wood, 2017) as in package *mgcv* in R programming environment. Among morphological effects, the suffixed primes were greater facilitators of the RTS not only in comparison to unrelated verbs but also to their prefixed counterparts in Exprt. l. Suffix' effect only against the unrelated verbs was preserved in Exprt. 2 and was missing in Exprt. 3. Interestingly, the prefix' facilitat01Y effect was also obselved but in the accuracy analysis against the unrelated verbs in Explt. 3 only. To calculate the necessary pool for the replication, I used *extend* method from the *simr* package (Green&MacLeod, 2016). The necessary subject pool of 30 was identified to detect the suffix-over-prefix effect from Exprt.1 with 80% confidence. Using PCIbex online experiment builder (Zehr&Schwarz, 2018), and recruiting the participants through Toloka, a Yandex crowdsourcing platform, I collected the online data. The only difference between the designs was the timeout of the response waiting time, which was 2000ms offline and a button press online. Eventually, the response times were longer in the online replicas. The suffix effect was observed only in comparison to the unrelated controls in Exprt. I and 2. Prefix' effect in Exprt. 3 for accuracy was also replicated, now also in comparison to the suffixed counterparts.

Discussion: My study shows that there are psychological differences in the organization of storage of the relative verbs, channeled through either of the derivatives, a result similar to the findings in Korean (Kim et al., 2015), where orthographically modified suffixed words kept their facilitation compared to the unrelated controls but prefixed ones did not. The emergence of the facilitatory suffix effect for the reaction time in the experiment with real primes and of the beneficial prefix effect in the accuracy results in the experiment with nonword primes suggest that multiple memory processes mediate morphological

connections of a base word with its two derivatives. This is in line with the studies on speed-accuracy trade-off (Kahana&Loftus, 2010). I can also tentatively conclude that the lexical properties being incorporated at later time points might also differ for either of the morphological processes.

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Title: Morpho-phonetic effects on Dutch final *-en*

Authors: Tim Zee, Louis ten Bosch and Mirjam Ernestus

The Dutch -en word ending, canonically pronounced [on], as in regen 'rain' or schoenen 'shoes', has long been a subject of interest due to the variability with which the final [n] is produced. Previous sociolinguistic work has found evidence that the pronunciation of Dutch final -en is extremely variable, both within and between speakers (e.g., Goeman, 2001; Van de Velde & van Hout, 1998). Some of the factors that have been found to play a role are dialect, speech register, and following phonetic context. Interestingly, the morphological status of -en has also been claimed to affect its pronunciation. Specifically, Van de Velde and van Hout (1998) found that final [n] is more frequently deleted if -en is a morpheme. Moreover, they suggest that this morphological effect is speaker-dependent. Although these older studies are very interesting in light of recent studies into the relationship between morphological structure and pronunciation (e.g., Plag, Homann, & Kunter, 2017), they suffer from a number of shortcomings. Firstly, they did not take into account potential lexical confounds such as form frequency. Secondly, they lacked the appropriate statistical tools to model between-speaker variation. Third, they only looked at the absence or presence of [n], even though morphological status has often been found to affect segmental duration as well (e.g., Plag et al., 2017). In the current research, we set out to (l) confirm the effect of morphology on -n deletion when lexical confounds are controlled for, (2) extend these findings to the duration of [n], and (3) use appropriate statistical modelling to investigate potential interspeaker differences in these morpho-phonetic effects.

To enable effective estimation of interspeaker differences and the effects of potential confounds of morphological status, we used a large amount of speech material: 40 000 tokens of 6000 words in the read-aloud stories in the Spoken Dutch Corpus (Oostdijk, 2000). These -en tokens were phonetically segmented and morphologically annotated using automated procedures. We distinguished between 4 types of morphological status: non-morphemic, plural nouns, plural verbs, and infinitive verbs. Given previous -n deletion studies, we expected more deletion in the morphemic categories. We found that plural nouns, plural verbs, and infinitive verbs were indeed less likely to be produced with a final [n] than non-morphemic words. Additionally, we expected that this effect would be mirrored in the duration of [n] when -en was produced as [on]. Accordingly, we found that the duration of [n] relative to [o] was shorter in the morphemic categories. To investigate interspeaker variation in these effects, we employed multi-level models with by-speaker random slopes for morphological status. We found a similar pattern for both the deletion and duration analyses. The non-morphemic and plural verbs categories contained relatively little variation. However, for plural nouns and infinitive verbs, clear differences between speakers emerged: in these categories, we found a wide range of -n deletion rates and relative duration ratios, see Figure l .

The explanation for these interspeaker differences depends on the explanation of the morphophonetic effects. One explanation might be that final [n] is more frequently reduced in the morphemic categories because it is less likely to be part of a lexical representation. However, plural nouns and infinitive verbs are cases of inherent inflection, which, according to Booij (1996), are more likely to involve lexicalization. It could be, then, that certain speakers use lexical representations during the production of these words, whereas others rely on

generalization, resulting in the observed variation. Regardless of the precise interpretation, this research provides additional evidence for the relation between morphological structure and phonetic realisation and raises questions about the generalizability of such relations across a population of speakers.

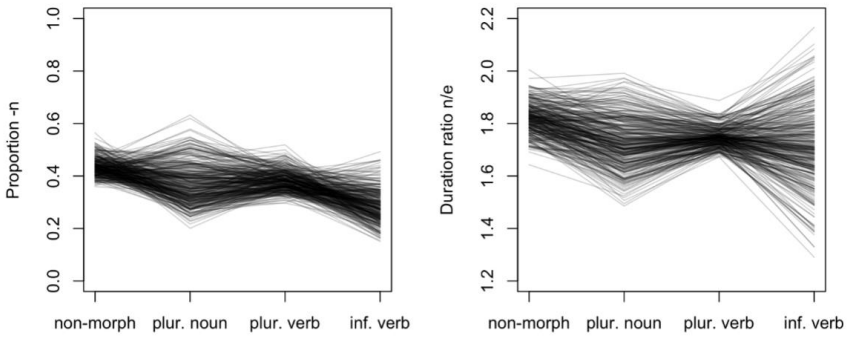

Figure 1: Left: By-speaker random slopes of morphological status in the -n deletion model. Right: By-speaker random slopes of morphological status in the relative -n duration model.

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Title: Language Performance and Exercise in Older Adults: A Scoping Review

Authors: Roya Khalili, Eva Kehayia and Marc Roig

Chronological and pathological aging can be accompanied by cognitive and executive function challenges. Information processing, attention, inhibition, and language performance can be affected in older adults with [1] or without[2] neurological conditions. A large body of research on exercise reports improvement in information-processing, reaction time, attention , and memory4 in older adults. Some of these cognitive functions are mediated by frontal and prefrontal brain regions', which are also involved in different language functions[6]. While the benefits of exercise on various cognitive functions have already been reviewed[5,7] , little is known about the effect of exercise on language performance. To address this gap, a scoping review was conducted to identify existing evidence on exercise-induced changes on language performance in adults aged 45-74 years with and without acquired neurological/neurodegenerative conditions. Furthermore, this review aimed to identify the language assessments used and the aspects of language performance measured.

The framework proposed by Arksey and O 'Malley (2005)[8] was used and eighteen key search terms were selected. Four databases including PubMed, Ovid, CINAHL, and Cochrane Library were searched. Studies published since 1990 were included if language performance was reported as an outcome of exercise interventions in older adults. The titles and abstracts of 337 articles were imported into the Rayyan platform, and two reviewers worked independently to select the eligible articles. A third reviewer, familiar with the field, was invited to resolve the conflicts. Full texts of the final 45 studies were assessed for eligibility and 27 studies were finally included. Ten studies were on healthy aging[9-18] and 17 were on older adults with acquired neurological/neurodegenerative conditions[19-38] . The three reviewers independently extracted the data using data extraction charts. The International Classification of Functioning, Disability, and Health (ICF)[39] was used to guide the categorization of results.

The 10 included studies on older adults without neurological/neurodegenerative conditions (N = 616, 522 females) indicated enhanced semantic and phonological Verbal Fluency (VF)[9-18] with 70% significant improvement[9-15] following exercise interventions. However, findings were inconsistent for older adults with neurological/neurodegenerative conditions. Among the 17 included studies with older adults with neurological conditions (N 1368, 791 females), 10 studies (58.82%) reported better picture naming/description, semantic VF , and phonological VF [19-29] while only four studies (23.52%) showed significant improvement [19-22] induced by exercise. In older adults with Parkinson's Dementia[21] , mild Alzheimer's Disease (AD)[25] Mild Cognitive Impairment , or cognitive deterioration[34] , exercise interventions yielded positive results in VF[19,20,22,28,29,31] and picture description[24] ; however, no significant change was observed in VF tasks for older adults with AD[26,33,23,42,35] or at the risk of AD[32] or with Major Depression Disorder[30]. In stroke, naming[23] showed improvement following exercise while VF[37] remained unchanged. Overall, language tasks which place more demands on linguistic processes and effortful executive functions mediated by frontal and prefrontal brain regions[37,38] seemed to respond better to exercise[3]. These findings are consistent with previous reviews assessing the effect of exercise on different aspects of cognitive performance[4,7] with selective benefits mostly for executive-control processes[4]. The present scoping review can help future research on language and exercise interventions in clinical settings.

Title: Context-based Prediction vs Post-access Integration of Second Language Word Processing

Authors: Essa Qurbi

This study investigated the effect of sentence context on second language word recognition process. English second language (L2) participants, along with native (L1) speaker participants as a control group, performed a cross-modal task (Holcomb & Anderson, 1993; Onifer & Swinney,1981; Swinney et al., 1979) where they were asked to make a lexical decision on a visually-presented word while listening to either a semantically related or a semantically nonrelated English sentence. It is to test whether both groups of participants are able to predict the upcoming word based on the preceding sentence context. The effect of context on word recognition has been a topic of investigation in the field of psycholinguistics for a number of years so far where amble evidence has been presented suggesting facilitative effect of prior semantically-related context on upcoming word recognition time in the native language (L1) (e.g., Boston et al., 2008; Demberg & Keller, 2008; Hale, 2001; Leu, 2008; Linzen & Jaeger, 2015).

With respect to L2 context-based word recognition process, different studies found conflicting results as some studies found a facilitative effect of a context on word recognition time (e.g., Ito et al., 2017), although in a longer time compared to native speakers, while others (e.g., Martin et al., 2013) did not find a prediction effect of a semantically high-constraint context on L2 word recognition time compared to a semantically low-constraint context. Therefore, the present study sought to answer whether there is a prediction-based processing on an upcoming word in the native and the non-native language.

The study sample consisted of 36 adult English native (L1) speakers and 36 adult English advanced-level non-native (L2) speakers. The participants performed a cross-modal task where they were asked to carefully listen to a recorded sentence and were instructed that a string of letters will appear on the center of the screen while listening. A participant's job was to decide whether the presented string of letters is a word or a non-word in English (lexical decision) by pressing a designated key on the keyboard as fast as possible. The visually-presented words were semantically (1) highest cloze probability (HCP), (2) next to highest cloze probability (NHCP), or (3) unrelated to the preceding sentence context.

The results showed that the L1 speakers were able to predict an upcoming word based on the preceding sentence context. That is, the higher the cloze probability is, the significantly faster the recognition, indicating a prediction-based processing. On the other hand, L2 speakers showed no significant difference between the HCP and NHCP, although each type of these was significantly recognized faster than the unrelated word. This could indicate that the L2 participants did not show a prediction-based processing as the L1 participants do.

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Title: Word Age of Acquisition Effects on Bilingual Younger and Older Adults' L1 and L2 Reading Behaviour: An Eye-Tracking Investigation

Authors: Narissa Byers, Courtney Stacey, Gabrielle Levasseur, Debra Titone and Veronica Whitford

Background: The healthy aging process can impact a variety of neurocognitive functions that are crucial to older adults' functional independence and quality of life, such as reading. Surprisingly, however, relatively little experimental research has investigated reading in this population, predominantly focusing on monolingual older adults (McGowan et al., 2022). As a result, much less is known about age-related changes in reading among other language groups, such as bilinguals. With aging and bilingualism rates on the rise nationally and internationally (Statistics Canada, 2021), it is important to develop a better understanding of how they jointly influence reading. A recent eye-tracking study has, however, examined how some key lexical properties, such as word frequency and word predictability, influence bilingual older adults' first-language (Ll) and second-language (L2) reading of naturalistic texts (Whitford & Titone, 2017). It found that bilingual older adults experience more effortful reading behaviour compared to matched bilingual younger adults, evidenced by reduced word-level reading fluency (e.g., longer gaze durations and total reading times for lower-frequency words, leading to larger word frequency effects), but that both age groups similarly capitalize on contextual constraint (i.e., comparable word predictability effects). It also found both age groups similarly experience larger L2 vs. Ll word frequency effects, but language-invariant word predictability effects. Here, we build on this study by examining how another important lexical property, word age of acquisition (AoA)—the age at which words were learned, influences matched bilingual younger and older adults' eye movement reading behaviour. This work was inspired by a recent eye-tracking study suggesting that word AoA may be a stronger predictor of bilinguals' reading behaviour, especially in their L2, than other lexical properties, such as word frequency (Dirix & Duyck, 2017). However, it exclusively focused on young adults (university students).

Methods: Sixty-two cognitively healthy French-English bilingual older adults (61-87 years) and 62 matched French-English bilingual younger adults (19-30 years) read four paragraphs (—250 words each coded for AoA and other lexical properties, such as word frequency), two in their Ll and two in their L2, while being eye-tracked. Both early-stage (gaze duration) and late-stage (total reading time) eye movement measures were examined.

Results: Linear mixed-effects regression models, with age group (younger adults, older adults) x paragraph language (L l, L2) x word AoA rating (continuous) as fixed effects, revealed robust word AoA effects, the finding that words learned earlier in life are read more easily than those learned later in life, in both age groups (across both eye movement measures). However, the magnitude of these effects was larger in bilingual older vs. younger adults (across both eye movement measures) and larger during L2 vs. Ll reading (again, across both eye movement measures). The three-way interaction did not reach significance. There was also some evidence that word AoA effects were more robust than word frequency effects, consistent with Dirix and Duyck's (2017) work.

Conclusions: Taken together, our findings suggest that word AoA exerts a strong influence on bilinguals' eye movement reading behaviour, especially when experiencing age-related cognitive changes: older adults, and especially under conditions of reduced lexical

entrenchment: L2. This latter finding is likely because L2 words are generally learned later, resulting in less extensive semantic networks. L2 words may also be not as readily accessed from semantic memory due to weaker links between different kinds of word-related information (Gollan et al., 2008) and/or lower baseline activation levels (Dijkstra & van Heuven, 2002).

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Title: Bilingual Processing Costs in L1 Production are Restricted to Non-Cognate, High-Frequency Words

Authors: Nadine Charanek, Vegas Hodgins and Olessia Jouravlev

How prevalent are bilingual costs during native (L1) speech production?

Knowledge of multiple languages has some clear benefits for one's personal and professional life. However, managing multiple languages in one mind is associated with some costs in the language domain. Indeed, infants growing up in bilingual environments are often delayed in language acquisition (Genesee et al., 2004). Adult bilinguals make more speech errors, have smaller vocabularies, and are slower in naming pictures and reading words than monolinguals (e.g., Gollan et al., 2005; 2007). Further, there are some claims that bilinguals experience communicative challenges not only in their second language but also in their native language (e.g., Sadat et al., 2016).

In this project, we asked two questions about prevalence of bilingual costs during native speech production:

(l) Are bilingual costs present equally for all items? and

(2) Are bilingual costs present equally in bilinguals of diverse linguistic backgrounds?

To answer these questions, we examined the picture naming performance of 65 English monolinguals and 72 English-French bilinguals. The participants named images of objects in English. The objects to be named were selected by crossing two factors. The first factor was a cognate status of a corresponding word (cognate (ball/balle) vs. non-cognate (cake/gateau)). The second factor was lexical frequency of a corresponding word (high frequency (ball/balle) vs. low frequency (cactus/cactus).

The results revealed a Group by Cognate status interaction: Bilinguals were slower to name objects compared to monolinguals if corresponding words were non-cognates. For cognate words, no group differences were observed. Further, there was a significant Group by lexical Frequency by Cognate Status interaction. Bilingual naming costs were higher for high-frequency than for low-frequency words, but this effect was restricted to non-cognates. Finally, in the exploratory examination of individual differences in bilingual naming costs, we observed that balanced bilinguals were more likely to show evidence for slower L1 naming latencies than bilinguals with more dominant L1.

These results are consistent with the view that bilingual costs arise due to competition between activated lexical items. First of all, bilingual costs do not arise for cognates because the same lexical item is activated across two languages. Secondly, these costs are higher for high frequency words because the corresponding words from two languages are more likely to get activated at approximately the same time and compete for selection. Finally, balanced bilinguals are more likely to activate competing lexical items from their two languages at closer temporal resolution compared to unbalanced bilinguals who will activate lexical items from their dominant language first. These results inform models of bilingual speech production.

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Title: Some errors are more harmful than others: the role of type and frequency of orthogonal errors in word processing

Authors: Natalia Slioussar, Daria Chernova and Ivan Gurkov

In the modern world of social media, we often read texts that were not subject to proof-reading and see many misspelled words. Several experiments on different languages have shown that the incidence of orthographic errors for a particular word reduces the quality of its lexical representation in the mental lexicon. As a result, not only further errors are made, but it is also more difficult to judge whether the word is spelled correctly, and more surprisingly it takes more time to read the word even when there are no errors (Rahmanian & Kuperman 2019; Kuperman et al. 2021; Chernova, Alexeeva, & Slioussar 2020).

In this study, our goal was to find out whether the type of orthographic errors (the orthogram) plays a role in addition to their incidence. We selected six orthograms in Russian forming two groups: more and less difficult ones (see Table l). 10 stimulus words were selected for each orthogram. Two experiments were conducted. In Experiment I (N=41), participants were asked to judge whether stimulus words are spelled correctly (half of them were presented in incorrect spellings). In Experiment 2 (N 52), all stimulus words were presented in the correct spelling in a lexical decision task, i.e. we measured how fast they are processed (there were also 60 nonce words).

Ordinal logistic and linear regressions with mixed effects (intercepts) by participant and by item, and Tukey tests for post-hoc multiple comparisons were used for statistical analysis. The overall word frequency, the relative frequency of incorrect spellings and the type of the orthogram were considered as factors. In Exp. l, the type of the orthogram played a significant role, being more important than other factors, and many pairwise comparisons between the types were significant. In Exp. 2, the influence of the type could be reduced to the incidence of incorrect spellings (i.e. its marginal significance disappeared once the incidence was included in the model).

To conclude, when we consciously decide how to spell, the type of orthogram plays a crucial role: some of them are more difficult. As a result, some errors are more frequent than others (although, obviously, their incidence can be only partially predicted by the type of orthogram). But when we simply read words, only the incidence of errors matters, i.e. the type of orthogram affects the reading speed only indirectly. This confirms the explanation by Rahmanian and Kuperman (2019).

Orthogram	Examples (correct and incorrect spelling)	Av. % of incorrect spellings	% incorrect answers (Exp. 1)	Av. RT in ms (Exp. 1)	Av. RT in ms (Exp. 2)
False double consonant	*prodjuser* 'producer'	8,100		1742,5	731,8
	**prodjusser*			1812,2	
Double consonant	kristall 'crystal'	7,000		1676,9	725,7
	**kristal*			1598 0	
Vowel after sibilant	*stazher* 'trainee'	6,500		1603,3	733,0
	**stazhor*			1849,0	

Uncheckable unstressed vowel	*natarius* 'notary'	3,600		1834,0	728,0
	**natarius*		400 0	1895,7	
Word-final consonant[1]	*sintez* 'synthesis'			1236,6	680 0
	**sintes*			1181,9	
Checkable unstressed vowel[1]	*ploshchadka* 'site'			1090,2	688,0
	**plashchadka*			1101,9	

[1] These two orthograms form 'the easy group' (the problematic letter can be checked by finding a word in which the same root is stressed or putting the word into oblique cases).

Title: Orthographic influences on spoken word recognition

Authors: Stefanie Türk and Ulrike Domahs

The acquisition of reading fundamentally changes the organization and representation of language in the brain and affects the processing of spoken words. Higher reaction times and lower accuracies were found in lexical decision tasks for auditorily presented words that contained orthographic inconsistencies compared to words with regular spellings (Ziegler & Ferrand, 1998; Ziegler et al., 2004; Ziegler & Muneaux, 2007). Studies using pruning paradigms showed increased pruning effects for auditorily presented words with orthographic and phonological overlap (e.g. *shirt — dirt*) compared to words with only phonological overlap (e.g. *hurt — dirt*) (Chéreau et al., 2007). In their 2009 study, Perre, Midgley and Ziegler used an auditory priming paradigm and a lexical decision task with neurophysiological measures to test for orthographic influences on spoken word processing. A target word (e.g. *reef*) was paired with three kinds of primes: phonologically and orthographically related (O+P+; e.g. *beef*), phonologically but not orthographically related (O-P+; e.g. *leaf*) and not related to the target (O-P-; e.g. *sick*). Their results show orthographic and phonological priming effects of different topographical distributions that became apparent as a reduced amplitude of the N400 component for 0+P+ and O-P+ conditions compared to a control condition. However, existing evidence is largely limited to French and English, two languages with a deep writing system. As reading acquisition as well as the relationship between orthographic and phonological representations is dependent upon orthographic depth, results might be different for languages with shallow orthographies (e.g., Landerl et al., 1997; Rau et al., 2015; Ziegler & Goswami, 2005).

To test this assumption, we replicated Perre et al.'s (2009) study in two different experiments with German-English late bilinguals. In the first experiment, we adopted Perre et al. 's experiment to test German stimulus material: A target (e.g. *Tee*, engl. 'tea') was preceded by either an 0+P+ prime (e.g. *See*, engl. 'lake'), an O-P+ prime (e.g. *Reh*, engl. 'deer') or an O-P- (e.g. *Lob*, engl. 'praise'). Participants showed a phonological priming effect that became apparent as a reduced N400 amplitude for 0+P+ and O-P+ primes compared to the O-P- prime. Surprisingly, an effect of orthographic overlap produced a significantly higher N400 amplitude for the 0+P+ condition compared to the O-P+ condition, indicating that an orthographic overlap in addition to a phonological overlap leads to inhibition m a shallow orthography. In the second experiment, we used Perre et al.'s English stimulus material. Participants showed a clear phonological priming effect that became apparent as a reduced N400 amplitude for the 0+P+ and the O-P+ condition compared to the O-P- condition. Moreover, we found a clear orthographic priming effect in the form of a reduced N400 amplitude for 0+P+ compared to O-P+ in a way similar to the English native speakers in Perre et al.'s study.

We conclude that orthography influences spoken word recognition in shallow and deep orthographies, but the direction of effects is modulated by the orthographic depth of the target language: In German as a shallow orthography, orthographic overlap produced inhibitory effects, while in English as a deep orthography effects were facilitating and strongly resembled the effects found by Perre and colleagues for English native speakers. We discuss these results within the Bimodal Interactive Activation Model (Grainger & Ferrand, 1994, 1996) and the Bilingual Interactive Activation Model (Dijkstra & Van Heuven, 1998, 2002).

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Title: What is the language of sound like?

Authors: Eleni Tzimopoulou, Jenny Hartman and Carita Paradis

While sensory perception is currently receiving quite a lot of attention across disciplines, little empirical research has focused on how people describe auditory experiences. Research on the representation of sound in fiction narratives has shown that sounds are frequently conceptualized as events whose descriptions are instantiated in domains other than sound proper, as in *strong men banging their way in and out of the cafe* (AUTHOR, 2020). It has also been found that when people are asked to describe sounds, the descriptions often foreground causal sources which relate to the listener's personal experiences, as in *I hear a shower running and coins being used to pay for the water* (AUTHOR, submitted) .When asked about whether run, use and pay evoke meanings of sound experiences, as individual lexical items, language users are likely to say no (e.g., Lynott et al., 2020).

Intrigued by these findings, we set out to investigate what participants do when they are asked to describe a sound to somebody who cannot hear it. How are the sounds worded and the descriptions construed? To this end, we asked 214 adult, native speakers of English to describe 20 everyday acousmatic sounds, i.e., sounds without corresponding visual input (Kane, 2014). The acousmatic stimuli were familiar, everyday sounds that ranged from ambient to more specific sounds (such as the sounds coming from a forest or someone brushing their teeth) and included both anthrophonic elements (such as a sigh or a snore) and sounds coming from non-human sources (such as check out machines or cars moving in traffic). The participants were not informed about what the sounds were or where they came from.

Our data include 3,875 written descriptions for the 20 sounds, a total of 51,089 words. We focused on the 8,244 verb constructions in the data. We inscribe our approach in the Cognitive Linguistics framework (e.g., Croft & Cruse, 2004; Talmy, 2000) and applied a specific model (AUTHOR, 2015) for the analysis of verb constructions. Two questions were at the core of the study:

1. What aspects of the experiences evoked by the sounds are foregrounded in the descriptions?
2. Are these aspects and constmctional uses the same across the individual sounds in the data set?

We identified three main descriptive foci that spread across the data: actual sound descriptions (as in *sound followed by moments of silence* /Apple/:9), source event descriptions (as in *someone eating an apple* /Apple/:9), and the perceiver's personal stance (as in *hate this sound a lot* /Apple/:78). The perception and representation of the sounds present both similarities and differences across the 20 sounds with regard to frequency and salience. For example, sound descriptions have low frequencies in all sound stimuli, but they might involve the perceiver's experience, as in *I can also hear a slight wheezy noise* (/Coughing/:17), or focus on the sound correlates exclusively, as in *it is a broad sound that in short bursts* (/Coughing/:175). Event descriptions dominate in all 20 sounds, but they are realized through different actions and entities as in *someone walking either up or down the stairs* (/Stairs/:12) versus *someone wearing dress shoes, perhaps heels* (/ Stairs/:16). The perceiver's personal stance appears in similar frequencies across the sounds, and it is realized mainly by descriptions of causal-reasoning relations between what is heard and the perceiver's

conceptualizations, as in *it sounds like a supermarket checkout* (/Store :29) and *I think what is happening is that* (/Digging/:50), or the perceiver's emotional reaction, as in *this sound is weird and rather gross* (/Tea/:120). We will report on both similarities across the data and some of the differences we found in the uses of verb constructions describing different types of everyday sounds. Our results yield new insights into how perceivers experience, conceptualize and contextualize the sounds, and we raise new questions about the multitasking of words in language and what the implications for the mental lexicon metaphor are.

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Title: Breaking into language in a new modality: Iconicity supports the recognition and comprehension signs at first exposure

Authors: Chloe Marshall, Julia Hofweber, Lizzy Aumonier, Vikki Janke and Marianne Gullberg

The universality— or not — of language-learning mechanisms has wide-reaching implications for the disciplines of theoretical linguistics, applied linguistics, psychology and language pedagogy. A substantial body of research has investigated Second Language Acquisition (SLA), but with an almost exclusive focus on spoken languages. Sign languages, in contrast, have been relatively neglected in SLA research, and very little is known about whether the learning of sign languages resembles that of spoken languages (Schönström, 2021).

The two studies reported here investigate sign language learning by sign-naive, hearing adults who are exposed to naturalistic sign language input for the first time. A key challenge when learning language in natura listic circumstances is to extract linguistic information from a continuous stream of speech or sign. We tested whether iconicity — a visual resemblance between sign forms and their meaning — would support two processes that are important for the early stages of lexical learning, namely (in Study 1) the recognition of phonological forms and (in Study 2) the comprehension of those forms' meaning.

We adapted the experimental paradigm of Gullberg et al. (2010) who investigated learning at first exposure in a spoken language (in their studies, Dutch speakers were presented with Mandarin input). In both our studies, British English-speaking adults viewed a 4-minute weather forecast presented in Swedish Sign Language. This forecast was constructed around 22 target signs that varied in their level of iconicity. Immediately after viewing the forecast, participa nts were presented with a surprise task. In Study 1, 93 participants were tested on their ability to recognise the target sign forms that had been viewed in the forecast, amongst distractor signs that had not been viewed. The results revealed that iconicity facilitated recognition of target signs. In Study 2, 80 different participants were tested on how accurately they were able to guess the meaning of the target signs, in comparison to 40 participa nts who had not viewed the forecast. Both groups had low levels of guessing accuracy (14% versus 9% respectively), and in both groups accuracy was greater for signs with greater iconicity.

Although it has been argued that iconic mappings between form and meaning are more plentiful in speech than previously acknowledged (Perniss et al., 2010), the visuo-gestural modality allows particularly rich opportunities for iconicity. Iconicity has previously been shown to be important for various aspects of sign language learning and processing, and in these two studies we have demonstrated that it has a supportive role in sign learning even at the very early stages of uninstructed and naturalistic exposure.

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Title: Lexical Decision in Simplified Chinese: A megastudy on 8105 Chinese Characters

Authors: Yixia Wang, Yanxue Wang, Qi Chen and Emmanuel Keuleers

In the last 15 years, the megastudy approach (e.g., Balota et al., 2007, Keuleers et al. 2010) has vastly increased the availability of lexical decision data for alphabetic languages. Megastudies, which collect response data for a large number of words, require a more substantial effort in data collection than a traditional experiment, but allow researchers to analyze the existing data without requiring new data collection (Keuleers and Balota, 2015). Still, lexical decision data for Simplified Chinese characters (used in mainland China by more than 1.4 billion people) are very limited compared to data from alphabetic writing systems.

Recently, Sze et al .(2014) have collected latencies for 2500 Chinese characters (CLP) and Tsang et al (2018) for 1 020 Characters (MELD-SCH). Although these studies are a valuable resource to researchers, the collected data cover less than one third of the commonly used Chinese characters published by Ministry of Education of the People's Republic of China (2013). In addition, lexical decision on Chinese characters is methodologically more complex than for alphabetic languages, and may offer room for improvement.

In this study, we collected latencies and accuracies for 8,105 characters from 41 Chinese speakers. A novel generation method was used to construct 4,864 pseudocharacters. Character frequency taken from SUBTLEX-CH (Cai and

Brysbaert, 2010) explained 50% of the variance in reaction times. Compared to the two existing megastudies in Chinese, we found that for high-frequency characters (above the 80th percentile), the new data had lower accuracy with longer response times. However, low-frequency characters (below the 25th percentile) were recognized more quickly and with higher accuracy. In general, pseudocharacters were responded to with higher accuracy and shorter response times. In virtual experiments, we were able to replicate effect of visual complexity found by Leong et al. (1987) but not effects of phonological neighborhood reported by Zhou et al. (2021). Results suggested that, for pseudocharacters, response times became shorter and accuracy became higher with additional complexity, suggesting an effect similar to that of wordlikeness for alphabetic languages. We hope these data will be a valuable resource for researchers wanting to explore visual word recognition in Chinese in itself and in comparison to other writing systems.

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Title: The second language acquisition of English expletives infixing: universals and complexity at the phonology/morphology interface in multilingual grammars

Authors: John Archibald and Mitchell Li

In this paper, we explore the L2 acquisition of English expletive infixing (McCarthy, 1982) a word formation process in which an expletive (e.g. *fucking, bloody*) is inserted into a root before the final metrical foot. We conducted a lexical decision task with 114 second language (L2) speakers of English who had varying first languages (L1s) some of which had metrical feet, and some of which did not. Some of the LIS used their metrical feet for stress (like English), others did not. The participants then chose between two versions of a word (n=25) with the f-word infixed into it at different locations. For example: *fan-fucking-tastic* vs. **fantas-fucking-tic*. The accuracy of the answers was then analyzed. None of the L1s allows such expletive infixing. We built the lexical decision task using the Python library PsychoPy (Peirce et al., 2019) and used the web-based experiment platform Pavlovia (pavlovia.org) to host the experiment and store data.

Our L1s were Mandarin (n=21), Spanish (n=14), Japanese (n=46), French (n=18), English (n=15), and we hypothesized that accuracy levels would be correlated with properties of L1 foot structure. We expected the Spanish (which uses feet for stress) group to perform the best, then Mandarin (which uses feet for tone sandhi), then Japanese (which uses feet for loan words), then French (does not have feet). The accuracy patterns are shown in Figure 1a.

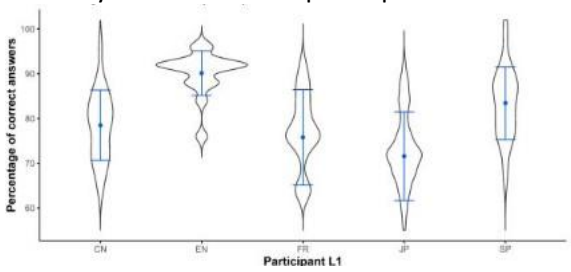

Figure 1a. Accuracy of judgements.

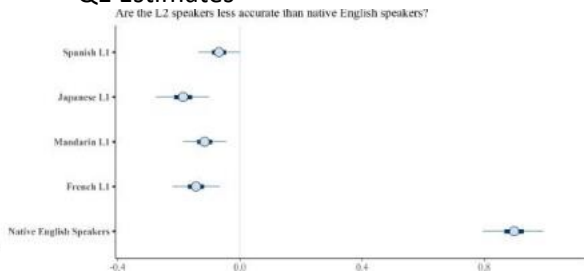

Figure 1b. Bayesian analysis.

We fitted two Bayesian logistic mixed models (brms package (version 2.14.4, Bürkner 2018) in R (version 4.0.2, R Core Team 2020) with accuracy as the outcome variable. Participants' first language was the only predictor in both models. We chose weakly informative priors for all model parameters. The results (in Figure 1b) indicate that when native English speakers were the baseline, the Spanish speakers were the most similar as the 95% Credible Interval (CI) for this group was the only one of the L2 English groups to include zero (posterior mean 0.07, 95% CI [-0.13, 0.00]). The other L2 speaker groups had lower posterior means and 95% Cls well outside the range of zero, indicating stronger evidence for their differentiation from the native English speakers than the Spanish L1 speakers. Taken together, the modelling results indicate that the Japanese, French, and Mandarin Chinese L1 speakers, while behaving differently from the native English speaker controls, were performing well (with accuracy averages in their second language between 7080%). These stimuli are, at best, low-frequency forms in the input and may, in fact, be absent from the input of most L2 learners. Furthermore, it seems highly implausible that such word formation rules would be taught in the second language classroom. These data suggest that (a) interlanguage grammars are hierarchical and not shallow (contra Clahsen & Felser, 2017), and (b) interlanguage grammars are recursive at

the foot level. The acquisition of such lexical forms is, thus, evidence of acquisition in the face of the poverty of the stimulus.

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Title: Mother-Child Dyads' Repetition of Words During a Shared Reading Activity Using a Wordless Picture Book

Authors: Katherine Reid and Alexandra Gottardo

Parent-child shared book reading has been shown to be beneficial in the development of language and literacy in preschool aged children (Leonard et al., 2009). The present study utilizes wordless picture books for a shared reading experience between 40 mother-child dyads. A goal of this study was to assess the mirroring of vocabulary items between mother and child when mothers led their child through a sharing reading task using a wordless picture book. Literature suggests that the use of wordless picture books may facilitate dialogic reading and literacy skills, as they allow for a story-telling experience, rather than simply reading text (Gettinger & Stoiber, 2014). More specifically when using a wordless picture book, the participants must make meaning without the use of text. The lack of text makes the reader use other information to understand what they are seeing, such as filling in icono-textual gaps, recognizing that there is a chronological sequence and connection between the images, and determining which pieces are significant to the narrative and which pieces are not (Arizpe, 2013). These processes are facilitated, by the adult during a story telling task with the child, through the adult's use of meaning-related interactions to encourage oral language. These interactions may include describing illustrations, discussing novel concepts, or making connections to the child's prior knowledge (Gettinger & Stoiber, 2014). Common ground refers to shared or mutual knowledge, and is a critical in communication (Clark, 2015). Repetition can acknowledge or ratify what the other person has said, which then establishes common ground (Clark & Bernicot, 2008). An analysis of spontaneous conversation between mother and child in the home environment found that both adults and children as young as 2 used repetition to place information within common ground (Clark & Bernicot, 2008). While repetition in spontaneous conversation has been assessed, this study assesses repetition during a shared book reading experience. This activity has structure from the picture book and leadership of the parent, while the lack of text leaves room for diverse conversations around the same story.

Method: Forty mother-child dyads (N=40) were recruited to participate in this study. Children were preschool and early school aged (children ages 3-5) (M age = 44.8 months; SD =10.02), with ages ranging from 36-68 months. Mothers were asked to engage in a story telling activity using a wordless picture book with their child.

Results: Preliminary analyses of 5 mother-child dyads were conducted. The number of verbs, nouns, adverbs, and adjectives uttered by mother or child that then was repeated by their counterpart was recorded. When mothers repeated after their child more frequently in the wordless picture book activity, the child followed the mother's model and also repeated the mother more often compared to dyads in which the mother did not repeat the child as frequently. In this subsample, all children who repeated their mother's adjective were agreeing with the emotional state of a character. In the one case where mother repeats the child's adjective, they were also agreeing on the emotional state of a character.

Discussion: In this study, we assess how the strategy of repetition of vocabulary can be utilized when engaging in shared reading activities. By using a wordless picture book, we examined dyadic patterns in activities that had greater structure than spontaneous conversation but less structure than traditional picture book tasks. This allows for an

assessment of vocabulary mirroring and establishment of common ground without any restrictions or assistance from text.

Title: Conceptualization of event roles: A cross-language comparison

Authors: Jiashen Qu and Koji Miwa

Event roles are an indispensable part of event construal because they encode information about "who did what to whom." For example, in the sentence "he kicked the ball," "he" is an agent that initiates the action "kicking" to a patient "ball" which receives the action. The previous studies demonstrated that in the linguistic encodings of event roles, entities that are more conceptually accessible are easier to surface as the subject, the emphasis of the sentence (Rissman et al., 2019). Animacy and agency are the two important factors that influence the conceptual accessibility: Animate entities are easier to surface as the subject than inanimate entities (Christianson & Ferreira, 2005), and agents are easier than patients (Gleitman et al., 2007). The cross-linguistic studies on the linguistic encodings of event roles showed that the Japanese language shows greater animacy advantage over agency than English language does in selecting the entities as the subject of the sentence (Ito, 2018). Specifically speaking, human is more likely to be chosen as the subject in Japanese than in English when human is a patient. For example, when describing a scene showing that a lion chases after a man, Japanese speakers tend to describe it as "a man is running away from a lion" whereas English speakers tend to say that "a lion is chasing after a man. "

Informed by the previous studies, we argue that conceptualization of event roles stands out as an interesting test case to probe how L1-based conceptualization influences the acquisition of a second language. We set up two hypotheses in the present study: (1) Influenced by the L1-based conceptualization of event roles, Japanese learners of English are predicted to have a more human-oriented perspective than native English speakers do when human is a patient, and (2) Japanese EFL learners behave more like native English speakers when they respond in L2 English than in L1 Japanese.

We prepared 50 images in each of the four categories of agent-patient actions chains: "animals chasing humans," "humans chasing animals," "humans throwing objects," and "disasters threatening humans." 44 native speakers of Japanese and 44 native speakers of English participated in the study via Google Forms. They were asked to describe the images in one sentence and write it down in a text box, except that the native speakers of Japanese were asked to do this task in both Japanese and English on different days.

We analysed the syntactic structure of responses from participants, where we focused on whether the agent was assigned the grammatical function of subject in the sentence. Using the generalized linear mixed-effects model with a logit link function, we found that across four categories of images, Japanese participants in both L1 and L2 show a greater tendency to describe human as the subject of the sentence compared to English participants. This human-oriented perspective in conceptualizing event roles by Japanese participants was observed both in the categories where humans are patients and in the categories where human are agents, which is partially inconsistent with our first hypothesis. The findings above demonstrate the transfer of L1 to L2 in conceptualization of event roles. More importantly, we found that the cross-linguistic effect is significantly smaller when Japanese learners of English responded in L2 English, which were in line with our second hypothesis. This result suggests that Japanese learners of English might have reconceptualized event roles when describing the images in L2 English. Moreover, we observed a significant effect of word frequencies in L2 English but not in L1 Japanese nor in L1 English, which might indicate that

reduced exposure to L2 gives rise to larger frequency effects, as predicted by the Frequency-lag Hypothesis (Gollan et al., 2011).

As far as we are concerned, this is the first study that addresses the linguistics encodings of event roles in a second language, which paves the way for exploring the cross-linguistic influence on the conceptual level (i.e., thinking for speaking) in the domain of event roles.

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Title: Is tone information available to L2 Chinese learners during L2 reading?

Authors: Rongchao Tong, Naoko Witzel, Xiaomei Qiao and Jia Chen

This study examines whether L2 learners of Chinese can activate both segmental and suprasegmental information, both of which are part of phonology, during L2 reading. There is enough evidence showing that native speakers can automatically activate segmental, or phonemic, information (e.g.,Tan & Perfetti, 1999) as well as suprasegmental information, such as tones (e.g., Winskel, Ratitamkul, and Charoensit, 2017), during L1 reading. Yet, little has been researched on whether such phonological – i.e., segmental and/or suprasegmental – information can be automatically activated during L2 reading. Interestingly, even though tones are critical for distinguishing Chinese words that share the same segmental information, neither segmental nor tonal information is reflected in Chinese writing. As such, Chinese makes it an interesting testing ground for how phonological information is activated during reading.

Native speakers (N=27) and L2 learners (N=28) of Chinese were tested using a Stroop task that required participants to name the ink color of visually-presented Chinese characters. Six types of stimuli were used: (l) congruent color characters (CCC; 红, hong2, "red" in red ink); (2) incongruent color characters (ICC; 红, hong2, "red" in blue ink); (3) homophones of the color characters (S+T+; 洪, hong2, "flood" in red ink); (4) different-tone homophones of color characters (S+T-; 洪, hong1,"bake" in red ink); (5) characters that shared the same tone but differed in segments with the color characters (S-T+; 瓶, ping2, "bottle" in red ink); and (6) neutral characters (S-T-; 牵, qian1, "leading through" in red ink). We predicted that if segmental and/or suprasegmental information is activated, then there should be facilitation when naming characters with overlapping segmental and/or tonal information. Significant Stroop facilitation was found in the S+T+, and S+T- conditions compared to the S-T- baseline condition for both native Chinese speakers and L2 Chinese learners. Interestingly, only native speakers showed facilitation in the S-T+ condition, suggesting that native speakers activate tonal information independently of segmental information. The L2 Chinese learners did not show any facilitation in this condition despite that they have high proficiency in their L2 Chinese (having passed HSK 5). The results suggest that native Chinese speakers could automatically activate both segmental and tonal information, and independently of one another. L2 Chinese learners, on the other hand, seem to activate segmental information automatically, but they did not seem to activate tonal information. We will discuss the results in terms of how phonological information is represented in L1 and L2, what the similarities and differences between L1 and L2 processing are, and consider what makes it most economical for L2 learners during L2 reading.

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Title: Decomposition in Production of Compounds in Persian: Effects of Spacing and Parts of Speech

Authors: Bahar Yousefzadeh, Sid Segalowitz and Gary Libbem

INTRODUCTION AND OBJECTIVES: Persian compounds have some unique characteristics, such as allowing for both spaced and attached constituents and for liberal use of noun (N), verb (V) and adjective (A) constituents. Thus, Persian permits addressing questions concerning these two factors not available in the many studies in English, Dutch, and German, especially with respect to spacing. The current study explores (1) the effect of spacing in Persian spaced compounds such as 'کلاه گیس, *'hat-hair*' for a *wig* against attached ones such as 'یخچال, *'ice-hole'*, for a *fridge*; (2) the effect of the constituents' parts of speech on the whole word processing; and (3) the effect of the functional part of speech of the whole word on the compound processing.

METHODS: 31 native speakers of Persian participated in an online platform where they typed out each of 182 stimuli after each was auditorily presented. Their reaction time (RT) of typing each letter is recorded and analyzed in a Linear Mixed Effect Model (LMER) in R.

RESULTS: The Decomposition Effect (DE) dependent variable is the increase in RT for the initial letter of the second constituent over the RT for the last letter of the first constituent, i.e., the degree of slowing after the constituent boundary. We conducted two sets of analyses. The first is with compounds classified as noun (N), adjective (A), and verb (V) types as follows: The N type consists of noun-noun compounds; V types had a noun-verb form; A types include any compound with a standard adjective. The second analysis involves a functional classification, i.e., whether the compound acts as a noun, adjective or verb. In addition, some Persian compounds have a space between constituents (including all those with verbs) and others do not. In the first analysis, the DE was significant for all compound types [74, 72, and 48 ms for N (n=73 stimuli), V (n=27) and A (n=29), respectively, with all $p<.02$]. N and V compounds did not differ ($p=0.5$). The DE for A was smaller than for both N ($p=.02$) and V types (p .02). In the second (functional) analysis, the DE remained significant for all compound types [73, 73 and 101 ms, for N (n=61), V (n 26), A (n=42)]. N and V did not differ ($p=.5$). However, the A DE was now significantly larger than those for N (p .001) and V compounds ($p=.06$). There was a strong overall DE ($p< 10^{15}$) and interestingly, spaced and attached compounds did not differ in this ($p=.16$). For spaced N, V, and A compounds, the DE comparisons in the first analysis yielded the same pattern of differences as for the overall analyses above. In the functional analyses, the DE increase for the A compounds altered the pattern: The A DE (100ms) was now significantly greater than for the N (59ms; $p<.001$) but only as a trend for the V (74ms;$p=.09$). In the attached compounds, N and A types did not differ ($p=.3$) with DE values of 86ms and 96ms, respectively. There are no attached V compounds.

CONCLUSIONS: (1) The fact that compounds in all types indicate a strong DE at the boundary aligns with Libben et al. (2014). However, compounds including an adjective constituent are more tightly bounded compared to NN and NV (reduced decomposition), but when the whole compound acts as an Adjective, its DE is largest of all. (2) Unexpectedly, spaced and attached compounds did not differ in the degree of constituent decomposition. (3) The interpretation of the doubled DE of compounds that function as adjective as a whole word compared to compounds that simply include an adjective raises new implications for how

compounds are stored in the mental lexicon. (4) The typing method presents a viable production approach to the study of compounds. (5) Persian yields new possible insights into the study of compounds.

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Title: Bringing the lexicon to life: An instance-based model of lexical behaviour and verbal memory

Authors: Nick Reid and Randall Johnson

Ever since Osgood's (1952) work on the semantic differential, psychologists have worked to derive numerical representations for word meaning. However, in the 1990s, the field leapt forward with the introduction of Distributional Semantic Models (DSMs) that apply machine learning techniques to extract vector-based representations of word meaning from text corpora (e.g., Landauer & Dumais, 1997; Jones & Mewhort, 2007; Mikolov et al., 2013).

Whereas DSMs have proven themselves as competent models of lexical representation, their predictions follow from a direct comparison of static lexical representations. The field must now turn to re-presenting the lexicon in a way that "brings it to life" and provides a complete process model for how those lexical representations are retrieved and applied to generate context/task-specific patterns of lexical behaviour.

To bring the problem into analytic scope, we developed a process model of lexical behaviour that leverages the vector-based lexical representations provided by DSMs with a classical yet modern exemplar-based model of human memory called MINERVA 2 (Hintzman, 1986).

MINERVA 2 is a computational model of cognition that articulates representation, storage, and retrieval from memory. The central assumptions of the model are that each experience is represented in memory by a unique trace and that retrieval is probe-specific, similarity-driven, and parallel. When a probe is presented to memory, it activates all traces in proportion to their similarity to the probe and a sum of activation is returned as an index of familiarity. If familiarity exceeds a certain threshold, the probe is recognized; else it is deemed "NEW".

Because a probe activates traces in memory that are identical to it, the model recognizes items that it has studied. However, because a probe activates traces that are partially similar to it and familiarity is equal to a sum of activation over all traces, the model predicts false recognition of unstudied items that are related to items in the studied set. In so doing, the theory ought to predict how people remember unstudied but related words and ideas.

In a series of simulations, we demonstrate that the MINERVA 2 model, when equipped with lexical representations derived from DSM models, anticipates experimental data on peoples' false recognition of unstudied words related by themes (Deese, 1959; Roediger & McDermott, 1995) and categories (Montagliani & Hockley, 2019) as well as unstudied phrases with related ideas (Bransford & Franks, 1971; Singer, 1973) and metaphorical themes (Reid & Katz, 2018, 2022).

Although our work demonstrates that a complete computational process model of word meaning can anticipate the complex influence of semantic relationships on verbal memory performance, our principal conclusion is that combining existing computational advances in both lexical representation and human memory provides a clear map forward for bringing to life computational advances on the problem of lexical representation and behaviour in the context of studying memory and decision.

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Title: Investigating semantic transparency in compound words using the visual world paradigm

Authors: Kelly Nisbet, Christina Gagne and Thomas Spalding

Compound words are an interesting category given they do not always abide by simple addition of the meanings of their parts. For example, you cannot simply combine the individual constituent representations (e.g., 'band' and 'wagon') to get the meaning of the full compound word ('bandwagon'). Questions remain regarding the extent to which these morphemes retain their original meaning and how they contribute to the overall processing and retrieval of the compound word in the mental lexicon.

One way to address these questions is by investigating semantic transparency (ST). Individual constituents vary in their ST when being combined to form compound words. This variation in ST is seen as a continuum from transparent (T) - the constituent contributes to the overall meaning of the compound, to opaque (O) - the constituent does not contribute. From this variable continuum, compounds can fall into four distinct categories: fully transparent (TT – 'gunpowder'), semitransparent (TO - 'honeycomb' and OT - 'trenchcoat') and fully opaque (OO - 'buttercup'). Additionally pseudo-compounds (P) are single words that happen to contain two independent morphemes (e.g., carpet). The nature and degree of relationships between constituents and whole words within these groups has been studied and debated for decades (see, Lieber & Stekauer, 2009 and Scalise & Vogel, 2010). ST is important in the compositionality debate as each constituent may play a different role in determining the compound meaning, depending on their ST. Prior research has investigated the challenges of operationally defining ST in relation to compound words (Gagne et al., 2016). Multiple measures of ST have been developed and used, however there is not yet consensus on the best approach. Here we present a novel method by investigating a decision-making task surrounding ST in compounds.

This study uses eye-tracking methodology to record and analyze eye-movements while participants make decisions about compound words using the visual world paradigm (see, Heuttig & Altmann, 2005 for an overview). In this task a word is read followed by a presentation of four images in each quadrant of the screen (one image represents the first constituent, one image represents the second constituent, and two images are unrelated to the word). Participants are instructed to read a word presented in the middle of the screen and press 'space' when they are finished reading. Once the space bar is pressed, the four images are presented simultaneously and are investigated for three seconds during the 'preview period'. After the preview period, a red dot is flashed in the middle of the screen and indicates that the participant should make their choice by fixating on the image that they feel best represents the word they read. We looked at how the participants eye-movements and processing patterns relate to the image they chose.

Preliminary analysis (n = 14) shows that when deciding between individual constituents of a compound, ST is a consideration. Decisions made appear to differ based on compound type ($X^2(4, N = 14) = 28.903$, $p < .001$). This difference stems primarily from the OT and TO compounds where participants tend to choose the T constituent over the O (Figure l). We found that the time spent looking at an image correlated with the likelihood of that image being chosen (Figure 2). In particular, for OT and TO compounds, the T constituent was processed significantly longer than the O ($t(62) = 4.195$, $p < .001$ — OT; $t(39) = 5.412$, $p < .001$

— TO). Time spent processing constituents did not significantly differ for 00, TT, and P categories.

Data collection is ongoing, and analyses will be presented on the larger dataset (n = ~60).

This study adds to the ongoing discussion of how best to operationally define semantic transparency in compound words. Furthermore, it provides insight into the online processing of various compound words, how eye-movement patterns relate to decisions regarding overall meaning of compound words, and the role semantic transparency plays.

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Title: Differentiating the (in)distinguishable: a quantitative investigation of the phenomenon of absolute synonymy

Authors: Peter Hendrix and Sorina Matiu

A question that has occupied the minds of linguists and philosophers for centuries is: can two words have the exact same meaning? The concept of two words having the exact same meaning is referred to as "absolute synonymy". The prevailing definition of "absolute synonymy" is based on the Firthian idea that "you shall know a word by the company it keeps" (Firth, 1957). Two words, under this definition, are absolute synonyms if and only if all their contextual relations are identical (Cruse, 1986). The dominant opinion among linguists is that absolute synonyms are either rare, or do not exist altogether (see e.g., Edmonds & Hirst, 2002; Saeed, 2009). This fits well with the classical idea that different forms must have different meanings (Bloomfield, 1933). Indeed, the existence of absolute synonymy would result in more complex languages, which are harder to learn (see e.g., Brighton et al., 2005) and result in increased processing costs (Kemp, Xu, & Regier, 2018).

Proving the existence — or the lack thereof of absolute synonymy, however, is less-than-trivial. In fact, Stanojevié (2009) referred to absolute synonymy as a theoretical concept, "because it cannot be proven". Leveraging the information offered by distributional semantic models in a creative manner, however, it is possible to establish if the contexts in which two words occur are identical and therefore - under the definition provided above - if both words are absolute synonyms. Here, we present the results of an investigation of absolute synonymy through an analysis of cosine similarities in a word2vec model (Mikolov, 2013) trained on the latest dump of all Wikipedia articles 3 billion words). Specifically, we investigated the cosine similarity between all word pairs listed as members of the same synonym set in Wordnet (Miller, 1995). To guarantee stable and reliable semantic vectors, we restricted our analysis to words that appeared at least 500 times (0.17 per million) on Wikipedia. This resulted in a data set of 53,997 word pairs.

Due to the fact that a corpus is a sample of the language as a whole, the sets of contexts in which two words appear in a corpus will never be the exact same, even if both words are absolute synonyms. In the event that two words are absolute synonyms, however, the sets of contexts in which both words in a synonym pair appear in a corpus should be as similar as two sets of contexts for the same word in the corpus. To be able to establish if this was the case, we randomly tagged each word token in the corpus with a "1 " or "2". For the word "lexicon", for instance, each occurrence was randomly recoded as either "lexicon1" or "lexicon2". Doing so allowed us to calculate not only the cosine similarities between two different words, but also the cosine similarity between a word and itself We repeated the process of randomly tagging each word in the corpus 10 times to be able to calculate confidence intervals and run statistical tests.

The median cosine similarity between a member of a word pair and itself (i.e., of "synonym_1" and "synonym_2") was 0.987, This confirms that semantic vectors provide a stable estimate of the contexts in which a word occurs, at least within a corpus. Through a series of Welch two sample t-tests, we then compared the similarity of both words to themselves to the similarity of one word to the other for all word pairs in our dataset. For both words in each word pair, the similarity of a word to itself was significantly higher than the similarity of a word to the other word in the word pair (all Holm-corrected $p < 0.05$). The two words closest to absolute

synonyms in our data set were "distinguish" and "differentiate" (similarity "distinguish" to itself: 0.997, similarity "differentiate" to itself: 0.993, similarity "distinguish" and "differentiate": 0.957; $p < 0.001$). For each word pair in the data set, therefore, we were able to establish that both words were not absolute synonyms. The current results provide evidence for the idea that - in line with the interests of the language processing system - absolute synonymy does not exist.

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Title: Syllabification in Hindi: An intuitive mental process

Authors: Rita Mathur

This paper reports the syllabification of word-initial and word-final clusters by native Hindi speakers. Syllable structure in Hindi has preferences or constraints on the occurrence of various syllable units. These preferences vary from word to word according to the number and nature of the syllables constituting the word. (Ohala, M.1983:57). In generative phonology these preferences or constraints are referred to as Morpheme Structure Condition (MSC). It is claimed that MSC reflect native speakers' intuitive knowledge and hence are psychologically real.

[ccvc] and [cvcc] syllables in Hindi occurring at the onset and coda position are atypical, violating the sonority sequencing principle (SSP) as proposed by Clements (1990). For instance, sibilant + voiceless stop in onset position demonstrates reverse sonority and therefore remains extra syllabic. According to Clement and Keyser (1983), a segment remains extra if it cannot be governed by a syllable node. These segments occur at the edge of the syllable and remain extra-syllabic. These are syllabified by breaking the clusters with vowel epenthesis either in the middle of a cluster or before a cluster. A word-final vocalic release is also observed, which is equal to a schwa. In the literature, this issue has attracted the attention of various Hindi phonologists. A long-standing debate has been observed in the past few years. A pro-schwa concept has been proposed by Dixit (1964), Srivastava (1979) to name a few. On the other hand, Ohala (1983) claimed that word-final vocalic release does not contain a schwa.

With these perspectives, the current study examines the syllabification process experimentally on one hand and, on the other hand, discusses the issues within the context of mental grammar. To obtain the data, a list was created that contained the words with initial and final clusters that violated SSP. The research data were obtained from five native speakers of standard Hindi. An acoustic phonetic analysis of the research data was carried out. The experimental results provided the evidence of systematic utilization of epenthetic vowels [a, i, u] in word-initial and word —final clusters. We tested the acoustic properties of the epenthetic vowels to authenticate the syllable structure as [vc.cvc] / [cvc.cv] type after syllabification. Acoustically, the duration and the quality of the vowel were determined, and therefore the perceptual properties of syllabification were validated.

Vowel epenthesis can be considered as a psychological reality of the utterances, and therefore a component of the mental lexicon, regardless of the lower or higher variety of the language.

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Title: Orthographic and phonological influence on spoken word recognition in bilinguals – Evidence from transposed letter, repetition and pseudohomophone priming

Authors: Stefanie Türk and Ulrike Domahs

An increasing number of studies suggest that orthographic representations influence spoken word recognition. Recently, two paradigms have been shown to be suitable to investigate influences of orthography on the processing of spoken words: the consistency paradigm and an auditory priming paradigm. Higher reaction times and lower accuracies were found in lexical decision tasks for auditorily presented words that contained orthographic inconsistencies compared to words with regular spellings (e.g., Ziegler & Ferrand, 1998; Ziegler et al., 2004; Ziegler & Muneaux, 2007). Studies using priming paradigms showed increased priming effects for auditorily presented words with orthographic and phonological overlap (e.g. *shirt – dirt*) compared to words with only phonological overlap (e.g. *hurt – dirt*) in a lexical decision task (Chéreau et al., 2007). Overall, these studies suggest that spoken word recognition is a bimodal process. However, the vast majority of studies have been conducted in English and French, two languages with a deep orthography. As orthographic depth influences the acquisition of reading as well as the connections between orthographic and phonological representations, it is conceivable that bimodal processing is also influenced by orthographic depth. However, the current paradigms rely mostly on orthographic inconsistencies, which are by far rarer in shallow orthographies, putting the investigation of such orthographies at a disadvantage.

As an alternative approach, we used a cross-modal masked priming paradigm with transposed letter (TL) primes and pseudohomophones in a lexical decision task to investigate the contributions of orthography and phonology to spoken word recognition in two languages of different orthographic depths. TL primes have been shown to prime their target only orthographically, while pseudohomophones are used for phonological priming (Grainger et al., 2006; Perea & Carreiras, 2006). German-English late bilinguals were randomly assigned to one of the two target languages German and English. Our stimulus material consisted of non-identical cognates (ger. *Bluse* – engl. *blouse*), translation-equivalent non-cognates (ger. *Flasche* – engl. *bottle*) and pseudowords (ger. *Frinke* – engl. *sicture*). In experiment 1, we presented participants with an auditory' target following 1) a TL prime (*BSOULE – blouse*), 2) a repetition prime (*BLOUSE – blouse*) or 3) an orthographic control (*BZOUTE – blouse*). In experiment 2, the repetition priming condition was switched for a pseudohomophone condition (*BLOWSE – blouse*). Primes were presented visually for 67 ms or 50 ms. Accuracies, reaction times and event-related potentials were measured from target onset.

The studies are ongoing, but preliminary behavioural results indicate repetition, TL and pseudohomophone priming in both languages irrespective of word type and prime duration. The neurophysiological data paint a more complex and differentiated picture: We found distinct patterns of facilitating and inhibitory effects of orthographic and phonological code activation depending on target language, prime duration and word type. Though TL priming effects could be observed for both languages, results suggest that TL priming is more pronounced in English than in German, especially for shorter prime durations and nonidentical cognates. Moreover, the time course of activation indicates early orthographic involvement in spoken word recognition, because TL priming occurred as early as repetition priming effects and even earlier than pseudohomophone priming effects. All in all, results

suggest an involvement of orthographic representations in spoken word recognition in both languages with a more pronounced effect in English.

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Title: Tell Me What You Mean (What You Really Really Mean)

Authors: Susan Lutfallah and Lori Buchanan

The current study operationally defined semantic richness as the depth and breadth of meaning associated with words. It also examined the relationship between known language variables and their relative contribution to semantic richness as a construct. A total of 60,000 subjective word ratings were explicitly collected from adult participants across 39 different countries who identified as speaking English as a first language. These ratings were compared to other known language variables to investigate the individual and collective relationships among them and determined their predictive influence on the collected ratings. It was found that although most variables were significantly related to the collected ratings and to other variables, together, 5 language metrics combined were significantly influential in predicting the variance in semantic richness, with sensorimotor contributing the most weight, followed by emotional arousal, body-object interaction, emotional valence, and association types. The findings from this study aim to bring awareness to the importance of using a scientific framework to understand the underlying components of semantic processing in order to better inform language interventions.

Title: Mix and match: why phonology matches syntax but not morphology in intraword codeswitching

Author: John Archibald

The properties of bilingual codeswitching are well-documented (Green & Wei, 2016; MacSwan, 1999; López, 2020). Stefanich (2019) and Stefanich et al. (2019) provide a descriptive and explanatory account of the morphophonology of intraword codeswitching (ICS) in which morphemes from more than one language occur within a single word. For example, a Spanish/English bilingual might produce the following sentence:

Voy a *hangear* con mis amigos
'I'm going to hang with my friends.'

This sentence contains a word which combines the English verb 'to hang' with Spanish verbal inflection to create a mixed or codeswitched word. ICS words can include a root from one language and affixes from the other. Furthermore, the affixes come only from the language which generates the syntactic tree (Alexiadou & Lohndal, 2018) while the root can be taken from either language. The data also strongly suggest that within such a morphologically mixed word, the phonology does not switch. Stefanich (2019) and Stefanich and Cabrelli Amaro (2018) presented both production and acceptability judgement data to demonstrate that, say, and English root with Spanish affixes would be pronounced with Spanish phonology.

The question I address here is why phonological switches are not licensed when morphological switches are. MacSwan & Colina's (2014) PF Interface Condition adopts a lexicalist model which assumes that morphology and phonology should pattern together. However, building on work within a non-lexicalist framework (Gonzalez-Vilbazo & Lopez, 2011; Lopez, 2020), I will argue that the empirical data are consistent with Distributed Morphology (Halle & Marantz, 1994) insofar as the vocabulary items are delinked from their phonological spell out. We find morphologically mixed X^O 's with a single phonology Interestingly, it seems to be the phrase (in this case x^o) which is the domain for phonological uniformity. This uniformity of word and phrase is consistent with, and hence further support for, a single-engine distributed morphology (DM) analysis of ICS (Alexiadou et al. 2015).

I assume, following Löpez (2020) and Libben (2022), that bilinguals have a single vocabulary list containing the roots of both languages. We have seen that we need no special bilingual machinery to account for the fact that the affixes come from the language of the syntactic tree; it falls out from the principles of DM. The mechanism which ensures that the phonology of the x^o matches the language of the affixes is Match Theory (Selkirk, 2011). The preferential mapping is between (a) syntactic phrases (XPs) and phonological phrases (O), and (b) syntactic heads (X^Os) and prosodic words (o). Match Theory's (monolingual) assumption that syntactic and phonological structure are isomorphic can easily be extended to bilinguals through language tags (Green & Abutalebi, 2013). The phonological spell out must match the language which triggers the generation of the syntactic structure. Again, no special architecture is required (Libben, 2000).

Note that ICS in comprehension is not a problem for the reasons outlined by Gwilliams et al. (2018) on the perception of phoneme ambiguity. Taken together, a non-lexicalist model of grammar supplemented by a tightly constrained syntax/phonology interface explains the morphophonological properties of intraword codeswitching.

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Title: Accessing phonological categories in adverse listening conditions: Data from adults with typical hearing, children with typical hearing, and children with hearing impairment

Authors: Marcel Schlechtweg and Mark A Gibson

Accessing pieces stored in the mental lexicon represents a complex phenomenon, and is especially challenging (a) if the individual cannot hear items in the way peers do and (b) if this process happens in a realistic environment with adverse listening conditions. Hearing impairment has been shown to affect several facets of language, such as vowels, consonants, or stress (see, e.g., Davies et al. 2020; Frank et al. 1987; Gilbert & Pisoni 2012). We ask here (a) how well Spanish adults with typical hearing (ATH), Spanish children with typical hearing (CTH), and Spanish children with hearing impairment (CHI) access the five vowel phonemes of their native language in noise / adverse listening conditions, (b) which vowels are correctly identified more and which ones less frequently, and (c) if the groups behave in a similar way with respect to the vowels they detect easily with difficulty. We refer to data from similar, but not identical, experiments, one testing the two groups of children and one testing the adults. We have so far tested 5 ATH (3 female, 2 male, 18—35 years), 4 CTH (4 male, 6, S, 8, and 10 years), and 6 CHI (4 male, 8, 9, 10, and 13 years; 2 female, 10 and 12 years).[1] They heard the isolated syllables /da, de, di, do, du/, produced by a male and a female speaker, and were requested to select the syllable they heard by clicking on one of the five textboxes they saw on the screen. The syllables were embedded in two types of noise, background babble and signal to-noise ratio. Note here that the experiment for the children (ExpCh) was different from the experiment for the adults (ExpAd). In ExpCh, background babble means that there were always 6 speakers; in ExpAd, there were l, 2, 3, 4, 6, 8, 10, or 12 speakers. Also, in ExpCh, there was always more signal than noise, while, in ExpAd, there was either more noise or a relation of 1 to 1 of signal and noise. We used a different experiment for the children in order to keep the task manageable, especially for the CHI.

We observe in Table 1 that, first, CTH responded overall more accurately than CHI, second, 10/ and /u/ are harder to detect than the other vowels in all of the three groups, and, third, CHI face immense difficulties in perceiving /u/ and still non-negligible difficulties in perceiving /o/ (and /i/).[2] We intend to collect more data, and interpret these preliminary results as first evidence for the general difficulty in accessing phonemes related to two acoustically close vowels (/o/ and /u/), which are similar in terms of F2 (both are back vowels) and F3 (both produced with rounded lips), in noise (see also, e.g., Bradlow 1995; Reetz & Jongman 2009). Fl (vowel height) could in principle distinguish between the two, but does so only to a limited extent and seems to be dominated by F2 and F3, especially in the absence of any visual input, which would possibly show the difference between the two vowels (lip aperture jaw angle). Our final results will then be interpreted against the background of the role hearing impairment and noise play in the process of accessing phonological categories.

Table 1. Mean accuracy by group and vowel (in percent)

Vowel	ATH	CTH	CHI

a	77	96	95
o	76	98	95
u	73	97	70
Total	55	72	63
	51	88	48
	66	90	74

[1]The data from one CTH was discarded due to a very low general response accuracy (29 percent).
[2]Note that we cannot directly compare the two groups of children to the group of adults since they were tested on different experiments, which explains why the adults show lower accuracy rates for most cases.

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Title: Analyzing acoustic and lexical words across dialects of English child-directed speech

Authors: Stephanie Archer, Jiaxing Li, Rachel Tu, Taryn Yaceyko, Hester Duffy, Michelle McGillion and Sotaro Kita

North American English-learning infants have higher vocabulary scores than British infants (Hamilton et al., 2000) and are more likely to detect individual words in sentences in a word segmentation task (Floccia et al., 2016). Yet, it is still unclear why this asymmetry exists. Perhaps the linguistic composition of a dialect differs in how child-directed speech (CDS) is manifested. That is, do mothers across dialects of English use similar characteristics when speaking in to their child? Specifically, we are interested in how mothers use words in a lexical or acoustic context.

Mothers with 18- to 24-month-old infants were recorded while reading 6 stories: 3 familiar creatures (e.g., *monkey*) and 3 novel creatures (e.g., *nembee*). Each story featured a target creature in 2 initial, 2 medial, and 2 final sentence positions. Recordings were analyzed for vowel pitch (Hz) and duration (ms) and lexical canier items. Canadian (n=7) and British mothers (n=7) were matched for infants' age, gender, and mothers' education. Due to COVID-19, recruitment and data gathering has recently resumed in person.

We measured stressed vowels for each target creature embedded in a sentence. Preliminary independent t-tests were conducted. Though we have found that British and Canadian mothers have similar CDS patterns, our current data show some interesting differences between the dialects. For example, using CDS along with sentences in medial position, Canadian mothers' pitch range are exaggerated when speaking about novel words (e.g., *nembee*) than British mothers ($p < .05$). This does not occur in familiar target words (e.g., *monkey*), nor in both initial and final sentences.

Regarding lexical items, our preliminary' data is also undergoing analyses (British, n=5; Canadian, n=5). Our current findings show that Canadian mothers produced higher counts of complete and partial repetition in CDS, isolation, and diminutives than British mothers found in spontaneous speech (see Table 1). We predict that English-speaking mothers will demonstrate differences across dialects in different ways. It may be the case that mothers' dialects may use dissimilar strategies when speaking to their children.

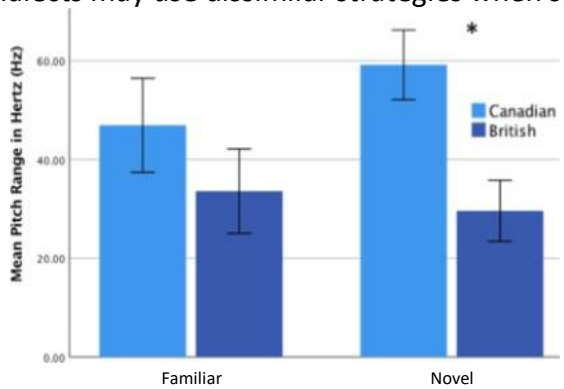

Fig. 1. UK & Canadian pitch range (Hz).

Dialect	Complete Rep.	Partial Rep.	Proactive Rep.	Isolatio	Diminutives
UK (n:5)	9	45	15		6
CAN (n=5)	17	66	13	19	14

Table 1. UK & Canadian lexical items.

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Title: Motor Manifestations of Lexical and Semantic Properties When Typing Compounds
Authors: Jordan Gallant, Gary Libben, Laurie Beth Feldman
BACKGROUND: The metaphor of the mental lexicon as a dictionary of stored knowledge about words has constrained the manner in which we think about morphology in production as well as recognition. One limitation of treating a word's lexical representation as static and relatively independent from that of other words is that compound words are treated as either transparent (e.g., 'blueberry') or not transparent with respect to their constituents e.g., ('hogwash'). This narrow focus between one constituent and one compound context makes it difficult, if not impossible, for researchers to converge on a way to quantify degrees of semantic transparency. A second is that retrieval of a motor plan for typing is taken as all or none under the assumption that the typing latency of a constituent's internal keystrokes is uninformative. An alternative account of how constituent meaning relates to compound meaning supposes that it emerges from a composite of role-dependent morphological contexts and that the focus of transparency extends beyond a particular constituent in a particular word context. The approach has been computationally implemented by Günter and Marelli (2021) in the framework of distributional semantics. In essence, the difference between free-word and as-constituent statistical structures provides a quantified measure of semantic consistency (see Gunther & Marelli, 2017). It serves as a quantitative proxy for morphological transcendence, as described by Libben (2014, 2021).

GOAL: In this study, we investigate the effects of semantic and lexical properties of modifiers in the production of English compounds to better understand what lexical and semantic properties of the constituents of a compound influence the motor program for typing it. We differentiate between latencies for the first keystroke (K1) associated with the retrieval of the motor program and latency by position for the execution of the remaining keystrokes.

METHODS: Participants typed visually presented strings. To maximally control for effects of word and constituent length, all were 8-letter compounds containing two 4-letter constituents. The core stimuli consisted of 30 real compound pairs (e.g., 'raindrop' and 'teardrop'). Each pair shared the same head constituent (C2) and included modifier constituents (Cl) with different positional compound family sizes (e.g., '#rain-', n=26; '#tear-', n=6). Non-word modifiers changed the first two letters of the Cls (e.g., 'geindrop' and 'thardrop').

RESULTS: Mean keystrokes were faster in compounds containing Cls with large families and Cls with lower modifier consistency ('#worm-' in 'wormhole' vs '#rain-' in 'raindrop'). Family size effects were limited to the typing of the first constituent and did not influence the typing time for K1 alone. Modifier consistency effects, on the other hand, were observed for keystrokes within C1, within C2 as well as initial keystrokes. We interpret these results as pointing to the interdependence of constituents and as showing that initial constituent (C1) as well as whole word frequency and lexicality influence noninitial keystroke latencies. In essence, the compound context in which a Cl appears impacts patterning throughout production.

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Platform Session 2.4

Title: Awakening metaphors: The literal meaning of a conventional metaphor can be awakened contingent on subsequent cues

Authors: Laura Pissani and Roberto G de Almeida

When individuals hear metaphors such as *early bird*, they interpret their figurative content rather fast and efficiently. Conventional metaphors have words that frequently co-occur, so they may be stored as lexicalized, non-compositional expressions, which require sense retrieval rather than sense creation (Bowdle & Gentner, 2005). But do conventional metaphors function as frozen expressions? We examined whether the literal meaning of a conventional metaphor could be triggered, or *awakened*, by a subsequent cue. To the best of our knowledge, the awakening of the literal meaning of conventional metaphors in real time has not been examined before. We hypothesized that the literal meaning of a conventional metaphor could be (re-)accessed in real time if it was cued in subsequent context. In Experiment l, we tested this by employing a maze task in which participants read sentences at their own pace and were presented with a lexical choice I to 3 words after the metaphor (e.g., *John is an early bird so he can…*). During the maze juncture, the appropriate word (e.g., *attend*) was paired with either a related distractor (e.g., *fly*), which was semantically associated with the literal meaning of the conventional metaphor, or an unrelated distractor (e.g., *cry*), which was not semantically associated. Both distractors fitted grammatically but were not semantically suitable to continue the sentence. Participants took significantly longer and were less accurate to select the correct word when it was paired with a related rather than an unrelated distractor. In Experiment 2, we examined whether this effect replicated when there was a medium (6 to 8 words) and a large (11 to 13 words) distance between the metaphor and lexical selection. Again, participants took significantly longer to select the correct word when it was paired with a related rather than an unrelated distractor in the medium and large maze, however, participants were significantly less accurate only in the medium, but not in the large maze. Overall, our results suggest that the literal meaning of a conventional metaphor is not circumvented, nor that metaphors simply involve lexical-conceptual retrieval. Further, they indicate that the awakening effect persists but decreases significantly as word distance increases, suggesting that the literal meaning is still available downstream but fades rapidly. The metaphorical awakening effect offers a novel perspective to the study of metaphors and suggests that metaphor processing mechanisms may shift depending on subsequent context.

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Title: Valence effects in the wild: Analysing word learning in language learning apps

Authors: Heather Wild and Victor Kuperman

One of the nagging questions in applied linguistics is how to make language learning easier. While numerous studies have identified robust frequency (Brysbaert et al., 2016) and concreteness (Kousta et al., 2011) effects on word learning, the effects of emotional valence are less established. Snefjella et al. (2020) and Ponari et al. (2020) found that words with positive valence like *chocolate* are easier to learn than negative words like *murder*. The emotional context in which words are presented also impacts learning. Participants more accurately recalled words learned in positive rather than negative sentences (Snefjella et al., 2020).

However, the valence effects from these studies tend to be relatively small, are based on highly controlled experiments, and often involve learning non-words. This raises the question of whether valence effects survive in real-world language learning environments. To address this gap, we analysed data from a popular language learning app: Lingvist (https://lingvist.conm'). In the app, learners see a fill-in-the-blank sentence (with its source language translation) and attempt to guess the missing word. We ask how word learning, operationalized as correctly identifying the missing word, is influenced by (i) the valence of the words themselves (e.g., *vacation* vs. *flu*), and (ii) the valence of the contexts in which novel words are presented (e.g., *I had a lovely time on* _ vs. *I was fighting a terrible* _).

We ran linear mixed effects regression models with by-participant and by-trial random intercepts and used the valence ratings from Warriner et al. (2013). Initial results show that valence of the novel word, as well as the valence of the context sentence, and the valence of sentences in the user's previous 5 trials are all significant predictors of successful learning. After controlling for word frequency, concreteness, cognate effects, and app usage, learners were 2.8% more successful at correctly identifying positive words in the target language than negative words. Learning words in positive sentences increased success by 2.3%. Finally, the higher the context valence in the preceding 5 trials, the more likely users were to succeed, showing a 3.9% increase from the most negative to the most positive conditions. Future investigation will consider interactions between valence and other key learning predictors.

The findings that word and context positivity boosts foreign language performance can be directly applied to language learning apps to improve their algorithms and selection of learning material. The study additionally replicates the effects found in previous studies, but in a more real-world learning environment. Thus, valence effects do indeed survive in the wild.

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Day 3: October 14, 2022
Platform Session 3.1

Title: Morphological and syllabic processing in L2 German

Authors: Mary O'Brien, Sarah MacDonald, Gary Libben

German is famous for its morphological complexity and productivity (Clahsen, Sonnenstuhl & Blevins, 2003), and this can cause difficulty for non-native speakers whose morphological systems are less complex and or productive. In this presentation, we use a language production task (typing) to examine the manner in which morphological effects are seen in the lexical production of native speakers and non-native speakers of German.

Previous work: Native speakers activate syllabic and morphological information automatically (e.g., Hess, Mousikou, Venel & Schroeder, 2019; Smolka & Libben, 2017), and researchers have concluded that they decompose complex and compound words into their component parts (e.g., Clahsen et al., 2003). Relatively little research has looked at the extent to which second language (L2) learners of German rely on sublexical information in their processing of L2 words, but studies investigating L2 morphological processing have generally concluded that L2 learners may rely more on lexical storage than on morphological parsing (e.g., Silva & Clahsen, 2008). In addition, these studies have demonstrated first language (L1, e.g., Alonso & Villegas, 2016) and proficiency effects (e.g., Coughlin & Tremblay, 2015).

Method: Participants were 22 German native speakers tested in Germany and 46 adult L2 learners with intermediate to advanced proficiency in German who speak French (N=21) or English (N=25) as an L1. They completed a typing task with progressive demasking. That is, they saw a word that was slowly revealed and then typed it. Response times from the typing task provide information about how participants chunk words as they process them. The 80 target items belonged to four categories, as in (1).

(1) Categories	Example	Translation
stem. stem. stem	Roll.schuh.bahn	roller skating link
stem. suffix	Vater.schaft	fatherhood
prefix. stem. suffix	Erz.feind.lein	small arch enemy
prefix. stem	Nach. saison	post season

Twenty simplex words (e.g. Hornisse 'hornet') sewed as a baseline. An additional task required participants to explicitly place morphological boundaries.

Results: Typing times slowed at syllable boundaries that were also morphological boundaries, but not at ones that were not. Typing times were also affected by the complexity of words, with tri-constituent compounds showing the strongest morphological boundary effects. This provides evidence of morphological planning among both native and non-native German speakers. We interpret these data patterns as supporting a view in which the processing of second language (L2) German words is morphologically informed and perhaps morphologically driven. We demonstrate that the typing paradigm offers an effective measure of online lexical processing that enables both quantitative and qualitative comparisons of native speaker and L2 learner performance.

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Title: Relational Priming Effects for Japanese Three-Character Kanji Compounds

Authors: Yasushi Hino, Junyi Xue and Mitsuki Tachibana

Because Japanese kanji characters represent meanings, words with multiple kanji characters are assumed to be compounds. Thus, when reading kanji compounds, they are assumed to be first decomposed into morphemes and, then, integrated to a whole-word representation (e.g., Taft, 2003). The purpose of the present study is to examine whether the decomposition/integration processes are involved when reading kanji compounds. There are mainly two types of three-character kanji compounds: right-branching and left-branching. According to Nomura (1974), most of these compounds consisted of a "modifier + head" structure. In the left-branching compounds, the two-character compound modifies the meaning of a single character head (e.g., 映画-館 (movie theater)). Similarly, in the right-branching compounds, a single character modifies the meaning of a two-character head (e.g., 核-兵 (nuclear weapon)). Using right-branching compounds as targets, we examined morphological priming and relational priming effects in our lexical decision experiments. In our experiments, we used two types of nonwords. In Experiment l, nonwords were created by combining existing single character and two-character compounds (e.g., 歯風船 (tooth-balloon)). In Experiment 2, nonwords were created by combining three very unfamiliar characters (e.g., 惶棹寤). Because it is unclear whether the same modifier must be shared when observing relational priming (e.g., Estes & Jones, 2006; Gagne & Spalding, 2009), we created 4 types of pairs to orthogonally manipulate morphological and structural relationships between the prime and target: l) both initial character and relational structure are shared (e.g., 亜硝酸–亜寒帯), 2) only initial character is shared (e.g., 亜鉛板–亜寒帯), 3) only relational structure is shared (e.g., 腕次第–亜寒帯), and 4) neither is shared (e.g., 羞恥心–亜寒帯). In Experiment l, we observed both the morphological and relational priming effects and the relational priming effect was larger for word pairs sharing the same initial character (i.e., modifier). In Experiment 2, on the other hand, we only observed a significant morphological priming effect. These results were consistent with the decomposition/integration hypothesis when reading kanji compounds.

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Title: Sensitivity to semantic information during the processing of L2 English compounds: Evidence from early and late Vietnamese-English bilinguals

Authors: Juliet Huynh and Naoko Witzel

This study investigates how sensitive second language (L2) speakers are to semantic information when processing L2 compound words. Many current models of morphological processing agree that native speakers decompose morphologically-complex words into individual constituents during the processing of these complex words (as in *cleaner* is made up of *clean* and *-er*), but disagree as to whether they are sensitive to semantic information during initial stages of morphological processing (as in whether *corner* primes *CORN*; Feldman et al., 2009; Rastle et al., 2004). Interestingly, a recent study found that early Vietnamese-English bilinguals were numerically more sensitive to semantic information than native speakers in an English associative priming study (Huynh & Witzel, 2018). In the same study, late - bilinguals did not show such priming in their L2 English. This present study tests whether early and late Vietnamese-English bilinguals show differential priming effects towards semantic information using L2 English compounds.

In order to test this, a masked priming study with four prime-target types were tested. These included a transparent-transparent (TT) condition where both constituents were related to the overall meaning of the compound (*saddlebag-SADDLE*), a transparent-opaque (TO) condition where the first constituent was related to the meaning of the compound but the second was not (*hopscotch-HOP*), an opaque-transparent (OT) condition where the second constituent was related to the meaning of the compound whereas the first was not (*grapefruit-GRAPE*), and an opaque-opaque (OO) condition where neither of the constituents were related to the meaning of the compound (*flapjack-FLAP*). Two experiments were conducted. The first experiment had the first constituent as the target (*saddlebag-SADDLE*), while the second experiment had the second constituent as the target (*saddlebag-BAG*). If it is the case the early bilinguals were more sensitive to semantic information, we predicted that they would only show priming when the compound had a semantically transparent constituent thus, only the TT and TO conditions would show priming in Experiment l, and the TT and OT conditions would show priming in Experiment 2. The late bilinguals, on the other hand, would presumably show priming in all four conditions.

Contrary to our predictions, all three speaker groups, native speakers (N=24 in Ex. 1 ; N=24 in Ex. 2), early bilinguals (N=24, average AoA 3.17, in Ex. l; N=24, average AoA 3.38, in Ex. 2), and late bilinguals (N=24, average AoA 13.63 in Ex. l ; N=24, average AoA 14.13, in Ex. 2) showed priming in all four conditions in both experiments. Crucially, there was no interaction between priming and semantic transparency. This suggests that when these bilinguals are processing compound words in their L2 English, they are not taking semantic information into consideration. The presentation will include discussions as to when bilinguals are sensitive to semantic information and suggestions for future studies.

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Poster Session 3.1

Title: Processing gender, number and case: lessons of forgetfulness
Authors: Daria Chernova, Daria Antropova and Natalia Slioussar

Attachment ambiguity resolution (when a modifier can be attached to the head noun N1 or the dependent noun N2 in a complex noun phrase, as in *the servant of the actress that was on the balcony*) is widely discussed in the literature [2, 4, 5, 6, 7, 9, among many others]. Attachment to NI is termed high (HA), attachment to N2 is termed low (LA). Initially, the preference for LA was assumed to be universal [5], and the Late Closure principle was introduced to account for it, but cross-linguistic variation was discovered later [e.g. 2, 6]. RC modifiers are analyzed in most studies, while we look at participial modifiers in Russian. We focus not on ambiguous sentences, but on the sentences in which the choice of attachment is disambiguated by the number, gender or case of the participle, revealing curious processing differences between these features.

Russian participles agree with nouns in number, gender and case. Chernova et al. [1] looked both at ambiguous examples (a) and at examples disambiguated by case (b) or number (c). Word-byword reading times were measured, and every sentence was followed by a question showing whether it was interpreted as HA or LA. In ambiguous sentences, HA was preferred, in unambiguous sentences, there were many interpretation errors. Notably, there were significantly more errors in LA conditions compared to HA and in case (C) conditions compared to number (N).

We concluded that case and number are processed differently and decided to compare them to the gender feature. Using the same methodology, we ran two experiments comparing gender (G) conditions (d) either to case (N=64) or to number (N=65). Logistic and linear regressions with mixed effects (intercepts) by participant and by item were used for the statistical analysis.

(i) We found an online preference for LA (RTS in both experiments: LA<<HA) and an offline preference for HA (errors: HA<<LA). Interestingly, no similar observations were made in the previous studies on Russian that looked at RCs [e.g. 3, 8]. (ii) Disambiguation by gender was more effective than by case and less effective than by number (errors: N<<G, G<<C). Thus, number is remembered very well, gender is relied upon less effectively, while case is forgotten very quickly and on a frilly unexpected scale (about 50% errors in the C-LA condition). Notably, Russian is a free word order language, so it is widely assumed that speakers heavily rely on case in parsing.

Explaining (i), we suppose that the Late Closure principle [5] might be universal after all, but only for immediate online processing. The fact that speakers eventually choose HA can be explained by Fodor's prosodic principle [4]: Russian words are often long, so RCs and participial constructions are heavy. The fact that Russian RCs show an HA preference online [3, 8] might indicate that RC processing is less immediate than participial construction processing.

As for (ii), we conclude that participants initially process all features, hence the online LA/'HA differences. Case information is used to understand the internal structure of the NP and its syntactic position in the sentence. But then this information is quickly forgotten. Number information is not forgotten because it is important for the discourse representation (e.g. how

many workmates are introduced in (c)). Gender is a permanent property of the noun, so it cannot be totally forgotten, but it is less salient than number. Such differences between features have not been observed before.

a. *Svidetel' ušel bez naparnika voditelja včera videvšego eto ograblenie*. AMB witness left without workmate$_{m.gen.sg}$ driver$_{m.gen.sg}$ yesterday having-seen$_{m.gen.sg}$ this robbery
b. *Svidetel' upomjanul o naparnike voditelja, včera videvšego/videvšem eto ograblenie*. C-LA/HA witness mentioned about workmate$_{m.loc.sg}$ driver$_{m.gen_sg}$ yesterday having-seen$_{m.gemsg/loc_sg}$ robbery
c. *Svidetel' ušel bez naparnikov voditelja, včera videvšego/videšix eto ograblenie*. N-LA/HA witness left without workmate$_{m.gen.pl}$ driver$_{m.gen.sg}$ yesterday having-seen$_{m.gen.sg/ge.pl}$ this robbery
d. *Svidetel' ušel bez naparnicy voditelja, včera videvšej/videvšego eto ograblenie.* G-LA/HA witness left without workmate$_{f.gen.sg}$ driver$_{m.gen_sg}$ yesterday having-seen$_{m.gen.sg/g.pl}$ this robbery

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Title: Pants on fire: Even true statements are harder to process when spoken by a politician
Authors: Vera Fiawornu and Juhani Järvikivi

We examined how the credibility of a speaker affects the hearer's processing of false (lies) vs true statements. Lying is a complex cognitive process which is more mentally taxing than truth telling (e.g., less hand and arm movements, reduced blinking and more pauses during speech, Debey et al., 2012; Dunabeitia & Costa, 2015; Lelieveld et al., 2016). At the same time, lying is a socially relevant skill, and in some social contexts, white lies can be easier to process than blunt truths (Moreno et al., 2016). We asked whether the processing of true vs false statements are influenced by who the speaker responsible for these statements is? We also inspected the extent to which agreement with the statements as well as their processing would be influenced by the comprehender's political ideology and personality.

We carried out a ratings task (N=80) and a self-paced reading task (SPR, N=137) online using 48 experimental vignettes in four conditions featuring either a tmstwolthy or an untrustworthy speaker (selected by a rating task based on Reysen's (2014) honesty scale) as speaking false (frequent conspiracy theories) or true statements (see below).

> *[The province's premier/ The grade school teacher] / briefed the audience/ on a report/ that traced the/ COVID-19 outbreak. / He said;/ 'Scientists have concluded/that the outbreak/ of COVID-19/ can be traced to/* ***transmissions from 5G masts****/ in Canada/ and elsewhere. / We await/ information from/ the research team.*

Following the main experiments, participants filled in the Right-Wing Authoritarianism (RWA) Scale and the Interpersonal Reactivity Index questionnaire (IRI).

Linear mixed-effects modeling showed an interaction between speaker and truthfulness: true statements were rated as less acceptable (p=.007) and less agreeable (p=.01) when spoken by an untrustworthy speaker, whereas there was no difference for false statements. Individuals with higher personal distress scores rated trustworthy speakers less favorably in the False and more favorably in the True condition. SPR results for the target segment (bold above) revealed an interaction, whereby reading times were longer for trustworthy than untrustworthy speakers in the False condition (example above) and vice versa in the True condition (p=.0009). There were significant three-way interactions between Speaker, Truthfulness and individual difference measures for perspective taking, personal distress (IRI) and right-wing authoritarianism (all ps< 005). Higher scores on perspective taking and lower scores on personal distress lead to faster reading times for tme statements spoken by an untrustworthy speaker. Higher scores in RWA lead to faster reading times in general. In addition, there was an interaction suggesting that this effect was stronger for false statements and less pronounced for true statements spoken by untrustworthy speakers; and vice versa for trustworthy speakers. We will discuss these effects in more detail in our presentation.

The results suggest that the identity of the person who gives truthful information affects the processing of those statements more than the speaker of false information. In the truthful condition, when the speaker was untrustworthy, ratings were lower and reading times were higher than that of a trustworthy speaker. Furthermore, this effect was qualified by reader-based individual differences in personality and political ideology. These results add to the growing body of evidence that shows that not only is language processing (immediately)

affected by social-contextual information but it is also rapidly affected by who the comprehender is.

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Title: How do you use a word? Building up lexical-usage statistics, 24-7.

Authors: Matthew Hc Mak, Adam Curtis, Jennifer Rodd and M Gareth Gaskell

Every word we know comes with a wealth of knowledge about its variety of usage, accumulated over a lifetime. How do we track and adjust this knowledge as new instances of a familiar word are encountered? A recent study (Gaskell, Cairney & Rodd, 2019) found that, for homonyms (e.g., *bark*), sleep-associated consolidation facilitates the updating of meaning dominance. Here, we tested the generality of this finding by exposing participants to (Experiment 1) non-homonyms (e.g., *balloon*) in sentences that biased their meanings towards specific interpretations (e.g., *balloon-helium* vs. *balloon-float*), and (Experiment 2) morphosyntactically flexible words (e.g., *loan*) in sentences where the words were used in their dispreferred word class (e.g., "*He loaned me $100*"). Both experiments showed that the prior experience influenced later judgements about the words more after a night's sleep than a day awake. We interpret these results in relation to an episodic-context account of language comprehension.

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Title: N-gram frequency effects for random word trigrams: evidence from elicited and spontaneous speech in German and Mandarin Chinese

Authors: Ching-Chu Sun and Peter Hendrix

The frequency of not only words, but also word n-grams is a robust predictor for lexical processing, with processing advantages for more frequent n-grams as compared to less frequent n-grams (Amon & Snider, 2010; Tremblay & Tucker, 2011; Tremblay et al., 2016). Against the background of exemplar-based models of language processing (see e.g., Bod, 2006, Daelemans & Van den Bosch, 2005), effects of n-gram frequency have been interpreted as evidence for the existence of mental representations above the word level (see e.g., Amon & Snider, 2010).

Thus far, experimental studies investigating the effect focused on processing advantages for fixed phrases or expressions. While not entirely unproblematic, the assumption of mental representations for the high frequency stimuli in these studies is a tenable one. This assumption, however, is less-than-appealing if n-gram frequency effects exist beyond the realm of highly frequent fixed phrases or expressions and are present throughout the n-gram frequency range, as this would require the storage of hundreds of millions or even billions of word n-grams.

Here, we present the results of a series of studies on n-gram frequencies effects in spontaneous and elicited speech in German and Mandarin Chinese. The word n-grams under investigation in these studies were random word trigrams, rather than fixed phrases or expressions. An example of a word n-gram in Mandarin Chinese, for instance, is “个毛孔都” (classier pores all). An example in German is "älteste Sohn der" (oldest son of). For each language we conducted a word naming experiment in Which we collected response times and pronunciation durations. Furthermore, we extracted pronunciation durations for random word trigrams from a corpus of spontaneous speech in German and Mandarin Chinese, respectively.

To investigate the (potentially non-linear) effects of frequency at different grain sizes, we entered the frequencies of the word trigrams, as well as their component word unigrams and bigrams into a Generalized Additive Model (GAM; Wood, 2017) that furthermore included variables known to influence pronunciation durations as control variables. Word unigram, word bigram, and word trigram frequencies are highly correlated. Prior to analysis, we therefore submitted the frequencies counts at different grain sizes to a Principal Component Analysis (PCA) with varimax rotation. This resulted in a set of orthogonal principal components, each of which had a high loading for one of the original frequency counts and a low loading for the remaining frequency counts.

We observed significant effects of (the rotated components corresponding to) unigram frequency, bigram frequency, and trigram frequency on response times and pronunciation durations in the word naming experiment and on durations of the pronunciations extracted from the corpora, both in German and Mandarin Chinese. The effect of word n-gram frequency was robust across elicited and spontaneous speech, as well as across the languages under investigation. The effects were linear or near-linear in nature, indicating that word n-gram frequency effects existed even in the lower parts of the frequency range.

As argued above, the presence of n-gram frequency effects for random word trigrams is problematic for storage-based accounts. The existence of dedicated representations for word

n-grams across the word n-gram frequency range would place enormous demands on the mental lexicon - not only in terms of storage capacity, but also in terms of lexical access. In our opinion, the current results fit better with an approach in which knowledge about co - occurrence patterns between words is acquired as part of the learning process and implicitly stored in the associations between words and their orthographic and phonological features, rather than through explicit representations (e.g., Baayen et al., 2011, Baayen et al. 2013).

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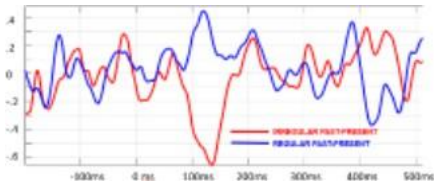
Title: Early ERP interaction of Regularity x Tense in English: Evidence from a verb production task

Authors: Sid Segalowitz, Osama Chattha, Harald Baayen and Gary Libben

The question of whether processing differences exist between the 'regular' English past tense (e.g., *walk — walked*; *jump — jumped*) and 'irregular' English past tense (e.g. *run— ran; shrink — shrunk*) has been at the center of controversy in mental lexicon research for over thirty years (Westermann & Jones, 2021). At the core of this controversy is the question of whether an adequate account of human lexical knowledge and processing requires that reference be made to linguistic categories such as morphological structure or regularity. This question has implications well beyond the specific details of English. In this report, we claim that new insights can be gained through the use of production tasks, which have been much less prevalent than recognition tasks, and an examination of the time course of processing through the recording of electrocortical (ERP) patterns.

Research Question: Do ERP patterns demonstrate whether retrieving past tense forms from the semantic mental lexicon differ for irregular compared to regular verbs in a way that present tense forms do not? In other words, is there an interaction between verb tense and regularity in the production of verb forms from the mental lexicon?

Past work: The limited past ERP work on this gave participants written lexical items and therefore did not require semantic retrieval (Budd, Paulmann, Barry & Clausen, 2013; Festman & Clausen, 2016). Also, their results did not show a language hemisphere effect or an early enough ERP sensitivity to suggest it was reflecting lexical retrieval. Other past work has amply demonstrated that reading accesses semantic information early (100-200ms) (Davis, Libben & Segalowitz, 2019; Hafer, Weissflog, Drolet & Segalowitz, 2022; Segalowitz & Zheng, 2009). METHODS: Participants learned to report the verb commonly associated with actions portrayed by a young woman in 139 pictures (e.g., sitting, walking, drinking) split 83/56 for regular irregular, respectively. Next, on each trial, verb tense was cued half the time by either "Right now, the woman is. . . " or "Yesterday, the woman . ' and then a picture was presented and they produced aloud the verb form with EEG timelocked to the picture onset (Biosemi 128 channels, 512 Hz sampling rate). We report only segments of at least 20 ms in which there was a .05 effect at every sample using bootstrapping (Campopiano, van Noordt & Segalowitz, 2018). Statistical probability for each adjacent point at .05 for a run of at least 20 ms (10 data points) yields $.05^{10} = 10^{13} \times 480$ (# of 20 ms runs over 500 ms) = $p < 5 \times 10^{-11}$. Thus, 20 ms is a highly conservative criterion.



RESULTS: We found at the *left prefrontal sites* (see figure) near Broca's area a strong interaction (showing a Regularity effect only for past tense and not present tense forms) over 100-145ms ($p < .00001$). The present tense ERP did not differ at any time across Regularity while the past tense forms differed significantly from 120147ms. The homologous *right prefrontal sites* yielded no such interaction, but did show a difference in past tenses across Regularity later at 330-356ms and for present tenses later still (410-442 ms). Given the ERPs were to pictures, we examined posterior regions as well.

CONCLUSIONS: We have demonstrated that the left prefrontal region distinguishes specifically the irregular past from regular past tense (and not the present tense forms) very early in the lexical access process (within 100 ms of the picture onset graphically illustrating the action). We

discuss the factors that may be at play in understanding how the irregular past tense challenges the cortex to produce this systematic distinction so early on and the consequences that this has for our broader conceptualization of the mental lexicon.

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Title: Vocabulary skills' assessment in L2 Finnish

Authors: Raymond Bertram, Minna Lehtonen and Rosa Salmela

Proficiency in a language is strongly related to how well and how many words one knows. Vocabulary knowledge correlates with reading comprehension and general communication ability. The Finnish vocabulary test Lexize (Salmela et al., 2021) is designed to assess vocabulary knowledge of L2 speakers. Lexize is a VLD-based online test for Finnish that consists of 102 items. Salmela et al. found that L2 test scores correlate strongly with exposure to Finnish and self-ratings. In the current study we modified the instructions to not only assess vocabulary knowledge but also word recognition speed. In addition we investigated to what extent the test correlates with the results from the national language proficiency test using the CEFR framework. Other factors that were assessed were duration of stay in Finland and Age of Acquisition of Finnish. The preliminary results with about 300 participants aged 20 to 76 years from more than 30 L1 language backgrounds indicate that (1) lexical decision times do not add much additional information about vocabulary knowledge skills; (2) vocabulary knowledge shows a moderate correlation with national test proficiency scores, mostly in the domains of reading and writing; (3) Duration of stay in Finland is a stronger predictor of vocabulary knowledge than age of acquisition. Implications of these results for the usefulness of vocabulary tests for language proficiency assessments will be discussed. Lexize is available for free use at https://psyk.abo.fi/LexizeWeb

Title: Morphological and syllabic processing in L2 German

Authors: Mary O'Brien, Sarah MacDonald, Gary Libben

German is famous for its morphological complexity and productivity (Clahsen, Sonnenstuhl & Blevins, 2003), and this can cause difficulty for non-native speakers whose morphological systems are less complex and or productive. In this presentation, we use a language production task (typing) to examine the manner in which morphological effects are seen in the lexical production of native speakers and non-native speakers of German.

Previous work: Native speakers activate syllabic and morphological information automatically (e.g., Hess, Mousikou, Venel & Schroeder, 2019; Smolka & Libben, 2017), and researchers have concluded that they decompose complex and compound words into their component parts (e.g., Clahsen et al., 2003). Relatively little research has looked at the extent to which second language (L2) learners of German rely on sublexical information in their processing of L2 words, but studies investigating L2 morphological processing have generally concluded that L2 learners may rely more on lexical storage than on morphological parsing (e.g., Silva & Clahsen, 2008). In addition, these studies have demonstrated first language (L l, e.g., Alonso & Villegas, 2016) and proficiency effects (e.g., Coughlin & Tremblay, 2015).

Method: Participants were 22 German native speakers tested in Germany and 46 adult L2 learners with intermediate to advanced proficiency in German who speak French (N=21) or English (N=25) as an Ll. They completed a typing task with progressive demasking. That is, they saw a word that was slowly revealed and then typed it. Response times from the typing task provide information about how participants chunk words as they process them. The 80 target items belonged to four categories, as in (1).

(1) Categories	Example	Translation
stem. stem. stem	Roll.schuh.bahn	roller skating link
stem. suffix	Vater.schaft	fatherhood
prefix. stem. suffix	Erz.feind. lein	small arch enemy
prefix. stem	Nach. saison	post season

Twenty simplex words (e.g. Hornisse 'hornet') sewed as a baseline. An additional task required participants to explicitly place morphological boundaries.

Results: Typing times slowed at syllable boundaries that were also morphological boundaries, but not at ones that were not. Typing times were also affected by the complexity of words, with tri-constituent compounds showing the strongest morphological boundary effects. This provides evidence of morphological planning among both native and non-native German speakers. We interpret these data patterns as supporting a view in which the processing of second language (L2) German words is morphologically informed and perhaps morphologically driven. We demonstrate that the typing paradigm offers an effective measure of online lexical processing that enables both quantitative and qualitative comparisons of native speaker and L2 learner performance.

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Title: Rhythmic stimulation boosts memory for new word forms in children

Authors: Bre-Anna Owusu and Elisabet Service

Performance in grammar judgement tasks and memory for new words are poorer in dyslexic children compared to typical readers. Previous research has demonstrated that regular musical rhythmic primes can benefit subsequent grammar processing in adults with dyslexia (Canette et al., 2020). Rhythms with regular beats orient listeners' attention over time—facilitating predictive cognitive processing. To test the presence of a rhythm attending effect on memory in dyslexic children and typical reading children, we adapted the methodology of a rhythmic-priming paradigm (Przybylski et al., 2013). In our procedure, thirty typical reading children first listened to 32-second regular or irregular rhythms. Following each rhythm prime, children were required to perform grammar judgements for grammatically correct and incorrect sentences containing a pseudoword. Children were also required to remember the pseudowords for a final recognition task. Results revealed that performances for pseudoword recognition were better after the regular prime sequences than after the irregular sequences. Similarly, our preliminary results for children with dyslexia reveal better recognition performances after attending to the regular prime sequences compared to the irregular sequences. Our preliminary results point to the benefit of using musical rhythms to boost verbal memory skills in dyslexic and typical reading children.

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Title: Influence of edge aligned constituent activation on compound word access

Authors: Alexander Taikh, Christine Gagné and Thomas Spalding

Constituent morphemes become activated during processing of compound words and are involved in the access of the whole word (e.g., Gagné et al., 2018; Libben, 2010). However, the way in which constituents are detected and extracted has not yet been established. To address this issue, we examine whether letters at the morphemic boundary play a special role in the activation of a compound's constituents by using a masked priming task to determine the effect of transposing and replacing morphemic boundary and constituent internal letters on accessing the compound. In doing so, we are able to evaluate what role uncertainty in letter position coding, which is assumed to occur early in word recognition, plays in morphological composition.

We conducted two experiments in which we examined the effect of transposing or replacing the letters of a masked compound prime (highlight) at the morphemic boundary (*hi**glh**ight* vs. *hi**gmk**ight*), inside of the first constituent (*h**g**ihlight* vs. *h**b**ohlight*), or inside of the second constituent (*highl**g**iht* vs. *highl**bo**ht*). In Experiment l, masked compound primes with a letter replacement (vs. letter transposition) slowed down lexical decision responses to their compound targets (*highlight*) when the manipulation was at the boundary but not when the letter manipulation was inside of the first constituent. Similarly, in Experiment 2, masked compound primes with a letter replacement at the boundary but not inside the second constituent slowed down lexical decision responses to their compound targets.

Our findings suggest that decomposition involves both letter detection and position assignment, and that these processes are influenced by morphological structure. Replacing boundary letters interferes with detecting constituents and activating their representations, which slows down access to the whole compound (e.g., Perea & Carreiras, 2006). In contrast, transposing boundary letters does not greatly hinder activating constituents relative to replacing letters due to imprecise letter coding. The transposed boundary letters can thus still activate the constituent representations even when they are in incorrect positions. Finally, replacing letters inside of one constituent still allows for access to the other constituent, which can compensate for the interference from replacing letters. This explanation is consistent with the edge-aligned activation theory of how constituents are activated during the processing of multimorphemic words (Grainger & Beyersmann, 2017). According to the edge-aligned activation theory, when a compound word is being processed, its embedded constituents are extracted from both edges (i.e., start and end of the word), and their representations are facilitated by the representation of the whole compound. Thus, activating one constituent of a compound helps activate the other.

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Title: Lexical and phonological factors in the word-superiority effect: Evidence from Arabic
Authors: Ali Idrissi, Arwa Nahia, Mariam Al-Taraireh, Sura Shalabi and Yousri Marzouki

Experiments using the Reicher-Wheeler paradigm (Reicher, 1969; Wheeler, 1970) have shown that fluent readers identify single letters better and faster when they appear in a word context than in a pseudo- or nonword contexts (Hildebrandt et al., 1995). This effect, known as the word superiority effect (WSE), has been shown to be robust under various conditions and in various languages using behavioral and, in a few cases, ERP data (Coch & Mitra, 2010). However, the question remains as to what linguistic factors play a role in this effect. Different studies point to different factors, spanning orthographic/lexical representation, phonological factors, and morphological structure (Chastain, 1981; Lin et al., 2017; Lupker, 2005; Maris, 2002).

In this study, we replicate WSE in Arabic and assess its sensitivity to abstract phonological representations. Arabic words typically consist ofthree root consonants mapped onto specific word patterns (e.g., the root √rs is found in different lexemes such as *daras* 'he studied', *daaris* 'studying', *mudarris* 'teacher', *madrasa* 'school' etc.). Interestingly, these abstract root consonant combinations are constrained by relatively strong phonotactic constraints, an observation first made by Greenberg (1950) and later attributed, within modern phonological paradigms, to the Obligatory Contour Principle (McCarthy, 1981, 1986) and Similarity Avoidance (SA) (Frisch et al., 2004). Under SA, the under- or over-representation of a given root consonant combination in the Arabic lexicon is a function of its violation of or adherence to SA. The more similar the three consonants in a root (similarity being measured in terms of the number of shared phonological features), the less represented this root is in the lexicon. We used Arabic triconsonantal roots and pronounceable nonroots, on which 60 skilled adults readers performed a within-string letter identification task. To explore the possible effect of phonology, we manipulated the factor "optimality", which reflects the degree of adherence to or violation of SA. We distinguished within roots and nonroots between combinations that *maximally* adhered to SA (optimal) and those that maximally violated it (non-optimal), with a category standing in the middle (sub-optimal). We hypothesized that WSE should be sensitive to the lexical (root vs. nonroot) status of the context as well as to the phonological structure (optimality vs. nonoptimality) of nonroots. Overall, our results showed better recognition of target letters in roots than in nonroots, a finding consistent with results obtained in the literature on WSE, including in a short study by Jordan et al. (2010) bearing on Arabic. Intriguingly, our results also show that while optimality was completely irrelevant in the root context, maximum violation of SA (nonoptimal) within the nonroot context led to significantly lower target letter identification accuracy than did medium (suboptimal) or minimum (optimal) violations of SA. We suggest that the better identification of letters in roots is due to the status of familiar letter combinations as "whole units" in the lexicon, which makes them easily accessible by working memory (Estes & Brunn, 1987), an advantage nonroots lack. We then argue that the better identification of letters in optimal and suboptimal nonroots is attributed to failure of phonological recoding of the three consonants in combinations that show extreme violation of SA. We conclude that WSE is sensitive both to early orthographic processing (in roots) and to later phonological processing (in nonroots). We discuss the significance of our results to the literature on WSE and the role of phonotactic constraints as abstractions holding over the phonological lexicon.

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Title: Phonological Processing Modulates Monolingual and Bilingual Children's Eye Movement Reading Behaviour

Authors: Sarah MacIsaac, Erika Guedea, Marc F Joanisse and Veronica Whitford

Reading skills are crucial for children's academic success. However, little experimental research has investigated reading behaviour in children using naturalistic methods, such as eye-tracking. Moreover, extant studies have predominantly focused on English monolingual children, leaving reading behaviour in bilingual children little understood. With bilingualism rates on the rise across Canada and the world, it is important to develop a better understanding of how reading unfolds in bilingual children. The current study helps address this gap in the literature by investigating how differences in phonological processing (i.e., ability to perceive, manipulate, and analyse speech sounds when processing written language), including phonological awareness, phonological memory, and rapid naming, among English monolingual (n = 34) and English-French bilingual (n = 33) children (aged 7 to 12 years) influence their first-language (L1) and second-language (L2) eye movement reading behaviour for a series of short stories containing words that vary in frequency. Thus, the current study focuses on how different language backgrounds (monolingualism, bilingualism), different language modes (L1, L2), differences in reading-related skills (phonological processing), and lexical properties (word frequency) interactively influence children's eye movement reading record. Regarding monolingual vs. bilingual children's L1 reading behaviour, linear mixed-effects models revealed two main findings: (l) lower L1 phonological processing (rapid naming) in both monolingual and bilingual children related to larger L1 word frequency effects (reflecting reduced L1 lexical accessibility) and (2) lower L1 phonological processing (phonological memory) related to differentially larger L1 word frequency effects among bilingual children (reflecting greater reduced L1 lexical accessibility). Regarding bilingual children's L1 vs. L2 reading behaviour, linear mixed-effects models also revealed two main findings: (1) lower L2 phonological processing (rapid naming) related to larger word frequency effects, especially in the L2 (reflecting greater reduced L2 lexical accessibility) and (2) lower L2 phonological processing (phonological memory) related to reduced L2 reading behaviour overall (irrespective of word frequency). Taken together, our findings suggest that reductions in phonological processing are associated with more effortful eye movement reading behaviour, especially under conditions of low lexical entrenchment: among bilinguals and during L2 reading. Our findings are largely consistent with leading models of bilingual language processing, such as the weaker links hypothesis (Gollan et al., 2008, 2011) and bilingual interactive activation plus (BIA+) model (Dijkstra & van Heuven, 2002), which propose that weaker connections between word-related information, such as phonology and orthography, as well as reduced baseline activation levels of words, lead to reduced reading fluency, evidenced here by a larger magnitude of word frequency effects.

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Title: The role of culture on first and second language naming task for youth and adolescents from immigrant backgrounds

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Bilingual language production involves the inhibition of one of the speaker's languages (Mosca & Bot, 2017). Past literature has demonstrated that when bicultural speakers produce words in their second language (L2), their first language (L1) is also activated in the phonological form of translation in those words (Hernandez et al., 2005; Klaus et al., 2017). In addition, research has investigated whether L1 words would activate L2 words, showing that co-activation of two languages is not confined to the dominant language. Since previous research had looked at the cognitive linguistic skills for bilinguals, the present study hopes to examine the role of culture on first and second language naming for youth and adolescents from immigrant backgrounds. The present study investigated whether there is an overlap in the naming tasks for both participants' L1 and English. The study also examined what types of labels the participants named for the words within defined categories, and whether similarities or differences exist across languages and between cultures.

Method: Undergraduate students who speak a language other than English as their L1 (N= 38; 10 Arabic speaking participants; 7 Punjabi speaking participants; 1 Kiswahili speaking participants; 2 French speaking participants; 8 Urdu speaking participants; 10 Chinese speaking participants) participated in this study. A Verbal Fluency measure was conducted on Zoom to use as a gross measure of participants' vocabulary knowledge in their heritage language and in English. In this task, participants were asked to name as many words as they can for two semantic categories (animals and foods) with 30 seconds being provided for each category for each language.

Results: Preliminary qualitative analysis showed that the Arabic, Chinese, Punjabi, Kiswahili and Urdu speaking participants named more food dishes from their culture in their heritage language than in English. Specifically, 40% of the Arabic participants; 80% of the Chinese speaking participants; 71% of the Punjabi speaking participants; 100% of the Kiswahili speaking participants; and 71% of the Urdu speaking participants named more than two food dishes from their culture. There was some overlap with the food items that were named in the L1 and English. For the English food naming component, the majority of the participants named either fruits and vegetables or North American/European foods such as pasta, fries and sandwiches. For example, 80% of the participants named more than two fruits or vegetables and North American/European food dishes. On the other hand, the French-speaking participants overlapped with English and French in terms of naming the foods. They named mostly fruits and vegetables instead of dishes of their culture.

Discussion: The findings suggest that the Arabic, Chinese, Punjabi, Kiswahili and Urdu participants are primed to think about their culture in terms of naming food items. Perhaps this pattern is due to the fact that they often eat the dishes of their culture. Thus, when they are asked to name food items in their L1, these dishes will be automatically generated. On the other hand, when they named food items in English, they tend to think about categories (e.g., fruits and vegetables) or they tend to associate 'English food items' (e.g., mac and cheese, fries, pizza) with the naming task. These findings suggest that a simple food naming task contains both linguistic and cultural elements.

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Title: Words sing their own tunes

Authors: Yu-Ying Chuang, Harald Baayen and Melanie Bell

Pitch, or fundamental frequency (F0), can reflect speakers' emotions and direct listeners' attention to the important parts of utterances. In English, it may also contribute to the stress patterns that we perceive for words, e.g. 'left stress' for language or 'right stress' for return. In Mandarin, on the other hand, each syllable is associated with one of five pitch patterns, known as lexical tones, which distinguish between the meanings of words that would otherwise sound the same. For instance, the high-level tone on 八ba, 'eight' distinguishes this word from 拔bá, 'pull', which has a rising tone. However, speakers produce far more variation in pitch than would be predicted by discrete categories such as tone or stress, and current linguistic theories are challenged by this variation, which crosscuts the boundary between tone languages such as Mandarin, and intonation languages such as English (Ho 1976; Grice et al. 2017). This study asks whether the currently unexplained variation in pitch is more structured and more informative than has previously been assumed. We show that, in both English and Mandarin, words have their own subtle but statistically clearly detectable pitch components, that we henceforth refer to as their pitch signatures.

Our English data consists of 16,016 audio tokens representing 239 two-syllable left-stressed word types from the Buckeye corpus of conversational American English. Our Mandarin data consists of 3919 audio tokens representing 53 two-syllable word types with a rising tone followed by a falling tone from the spontaneous speech corpus of Taiwan Mandarin (Fon 2004). For both languages, we used generalised additive mixed modelling (GAMM) to model the pitch of these tokens as a function of time, giving us precise predictions for the shape of the words' pitch contours. In addition to various fixed effect predictors, such as the words' frequencies of use and the sex of the speaker, we included by-word factor smooths to estimate an adjustment contour, i.e. a pitch signature, for each individual word type, extracted from all its audio tokens. These smooths represent the deviation of individual words' pitch contours from the general population curves representing left stress in our English data or rise + fall in our Mandarin data. For both languages, inclusion of the word specific smooths led to our models producing substantially more precise predictions, thus providing solid evidence for the existence of word-specific pitch signatures in these datasets.

Our results are highly innovative and significant for at least three reasons. Firstly, word-specific pitch signatures might explain empirical observations of language variation that have previously resisted linguistic analysis; secondly, they suggest that there might be more commonality between tone and non-tone languages than previously thought; thirdly, by identifying a new dimension of systematic lexical variability, they may go some way to bridging the gap between our understanding of human language acquisition and machine learning, if deep learning algorithms have been picking up and using these subtle pitch signatures which help to discriminate one word from another.

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Title: The Influence of Semantic Neighbourhood Density and Concreteness on Episodic Memory for Single Words

Authors: Brianna Fougere and Lori Buchanan

Studying the influence of semantic memory on episodic memory is important to develop a comprehensive model of memory. One promising method is using semantic richness measures to explore this relationship as it captures the depth and richness of semantic memory needed to facilitate comparisons to episodic memory (Duff et al., 2020). Previous research has examined the interdependent relationship of semantic and episodic memory by studying the effects of semantic characteristics, using different semantic richness measures, of single words on episodic memory tasks (Gonzales, 2018; Hargreaves et al., 2012; Lau et al., 2018; Nelson & Schreiber, 1992). Included in this line of research, Gonzales (2018) examined the influence of semantic richness on episodic memory using the measure semantic neighbourhood density (SND; Buchanan, Westbury & Burgess, 2021), which captures the degree of semantic relationships amongst words by measuring the distribution of semantic neighbours to a target word. Such research has shown faciliatory effects of SND on episodic memory for concrete words (Gonzales, 2018), however, previous studies have not examined the influence of SND on episodic memory using abstract words. The goal of the current study was to expand on this area of research by exploring the influence of SND for episodic memory of concrete and abstract words using a recognition memory task.

To answer the research question of whether SND influences episodic memory for concrete and abstract words, a recognition memory task was conducted. In this task, participants were presented with a list of words. Words were categorized based on SND and concreteness variables. Following a distraction phase, participants were presented with a recognition task to measure the retrieval of the previously studied list. The goal of the study was to compare average d' values (index of discriminability) across participants per condition (i.e., high SND abstract words, low SND abstract words, high SND concrete words, and low SND concrete words), where higher d' values indicates that participants were able to easily discriminate studied items from new items (foils). Results indicated a main effect of concreteness, such that concrete words were associated with higher d' values compared to abstract words, regardless of having high or low SND values. The results from the current study supports a concreteness effect of memory (Hamilton et al., 2001), such that there was a faciliatory effect for the recognition of concrete words compared to abstract words. In addition, results from the current study further support the dual coding theory of memory and cognition (Paivio, 1991). The current study is the first attempt to examine the effects of SND on episodic memory for abstract words.

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Title: Time as an embodied property of concepts

Authors: Charles Davis and Eiling Yee

What does comprehending the meaning of a word entail? For example, when we read words like haircut or merit, what mental process are engaged that allow us to understand the meaning of these words? Experience-based theories of semantic knowledge (i.e., sensorimotor or embodied theories; Allport, 1985; Barsalou, 1999) suggest that comprehending the meaning of a word (i.e., accessing its semantic representation) is about simulating what it is like to experience the thing that word refers to. So thinking about haircut entails activating aspects of the sensory, motor, perceptual, and emotional experiences associated with getting a haircut. But does it also activate information about temporal unfolding, and is information about this temporal unfolding of experience encoded in semantic representations?

Recent investigations have suggested that time might be a feature of semantic knowledge (e.g., Troche et al., 2014, 2017; for discussion, see Barsalou, 1999; Binder et al., 2016), but these accounts have generally focused on whether a concept is related to time, not whether semantic representations actually include specific information about time, like how long it takes for something to unfold in experience (cf. Davis et al., 2020). However, evidence from sentence processing suggests that people simulate the amount of time it would take an event to unfold when reading sentences (irrespective of actual sentence length).Reading sentences with durative verbs like “We were approaching the summit” takes longer than it does for those with punctive verbs like “We reached the summit”, suggesting that the amount of time an event takes to unfold is generalized from our experiences and stored in long-term memory (Coll-Florit & Gennari, 2011). Here, we tested whether the time it takes to experience an instance of a concept is activated when we process that concept in language (i.e., in lexical-semantic processing).

We tested 634 words present in Brysbaert et al.’s (2014) concreteness norms, Pexman et al.’s (2017) Calgary Semantic Decision Project, Balota et al.’s (2007) English Lexicon Project, and Mandera et al.’s (2019) English Crowdsourcing Project. For each of the 634 words, we asked participants to rate how much time it would take to “accumulate the information necessary to perceive” that thing (e.g., bowl, haircut, or merit). These time to perceive ratings were then submitted to linear regression models predicting lexical decision, word recognition, and semantic decision times from each of the mega-study datasets described above. (Models also included a host of lexical-semantic control variables—word length, frequency, concreteness, and age of acquisition—in addition to some created specifically for the present study, like conceptual distinctiveness, that is, how difficult it is to distinguish something from something similar, like banjo and mandolin.) Time to perceive was a significant predictor of lexical-semantic response latencies in all tasks, even when accounting for the effects of all control variables.

Ratings of how long it takes to perceive something in the world predict how long it takes to read a word referring to that thing in language. The results suggest that when reading words in our native language, we implicitly simulate how long it would take to perceive that thing. It is increasingly recognized that conceptual knowledge is experience-based, and that a range of experience-based knowledge is reactivated in accessing word meanings. Here, we broaden the scope of what is included in semantic knowledge, demonstrating that one such experience is how long it takes for us to perceive an instance of concept: The longer it takes for us to perceive something in the world, the longer it takes to play out in our minds.

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Title: The authors wrote the paper dry: contrasting resultative and depictive verb templates
Authors: Roberto G de Almeida and Caitlyn Antal

The representation of verb meaning has long been central to the investigation of compositionality. This is so because verbs specify the nature of their arguments, but also, by hypothesis, decompose into complex predicate-argument structures at the semantic or conceptual level of representation. A key test case for the verb decompositional hypothesis is that of resultative (1a) and depictive (2a) sentence constructions. By hypothesis, resultatives are more complex because they are represented by more predicates at a semantic or conceptual level of representation (Boas, 2003; Jackendoff, 1990).

(1) a. John cooked the fish dry
b. [CAUSE ([JOHN], [GO ([FISH, [TO [DRY]])]) [BY [CAUSE ([JOHN], [GO ([FISH], [TO [COOK]]]]
c. [John caused the fish to become dry] by [causing the fish to become cooked]

(2) a. John cooked the fish naked
b. [COOKED ([JOHN, [FISH) [WITH [BE ([JOHN, [AT [*NAKED*]])]]
c. [John cooked the fish] while [John was naked]

To our knowledge, only two studies have investigated the processing of resultatives and depictives (Frazier & Clifton, 1996; Pylkkänen, Llinás, & McElree, 2004), although these studies were not aimed at investigating the semantic template complexity hypothesis.

We report on two experiments investigating the verb-decomposition hypothesis contrasting resultative and depictive sentences. In these experiments, we controlled for the structural relation between the main verb and the secondary predicate in the resultative sentence (as in (1a)) by also creating minimal pairs in which the secondary predicate is close to the object of the main verb (e.g., resultative: *The waiter wiped the plate clean*; depictive: *The waiter carried the plate clean*). In Experiment I (N=40), employing a relatedness intuitions task (Levelt, 1970), results revealed participants' sensitivity to the scope of the secondary predicate (*dry/naked*), for both resultative and depictive sentences. However, results did not capture the hypothesized internal complexity of the main verb (*cooked*). In Experiment 2 (N 50), employing a self-paced reading task, participants took significantly longer to read depictive sentences than resultative sentences, thus, failing to capture the hypothesized internal complexity of the secondary predicate associated with resultative sentences. Taken together, our results suggest that verbs may not be represented by complex semantic templates with multiple internal predicates. We suggest that a theory which accounts for the representation of verb meaning without predicate-decomposition should be favored.

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Title: Gains in L2 vocabulary knowledge and reading speed predict future academic success: an investigation of EAL students following completion of an English bridging program

Authors: Daniel Schmidtke and Anna Moro

An increasing number of English as an additional language (EAL) students complete an English bridging program as pathway to an undergraduate degree. English bridging programs cater to international EALs who fulfill the academic requirements of the host institution, but who do not meet the language proficiency threshold to study at the undergraduate level. This longitudinal study investigates whether growth in component skills of reading in English during a 26-week bridging program contributes to future undergraduate academic success. Previous research has shown that literacy skills, such as vocabulary knowledge and word reading speed, predict the undergraduate academic performance of EAL students who enter via a bridging program route (Trenkic & Warmington, 2019). However, in these studies, component reading skills were assessed *upon entry* to undergraduate studies, i.e., after the completion of a bridging program, and thus failed to address whether *developmental changes* in the reading skills of bridging program EALs contribute to academic achievement. To fill this critical gap in the literature, the current study assessed change in a range of English literacy skills during multiple deliveries of a bridging program and tracked the subsequent academic performance of the same students during their undergraduate studies.

A total of 658 students, representing three successive cohorts of a bridging program, participated in the study. The students were tested on a battery of language assessments at the beginning (*t1*) and end (*t2*) of the bridging program, and their GPAs in future academic years were tracked. The test battery included measures of receptive and expressive vocabulary knowledge, phonological processing, decoding, morphological knowledge, spelling ability and reading comprehension. In addition, at both timepoints a measure of silent reading rate (words per minute) was obtained via eye-movement recordings of passage reading. Random forests modelling was adopted with the specific aim of identifying the relative contribution and ranking of the potential prognostic indicators of future GPAs, with a critical interest in the ranking of the developmental measures of component reading abilities. The residual change scores (*t2 – t1*) of each language test were included in the model as the critical developmental independent variables. Language test measurements at *t1* (baseline status), demographic information, IELTS subtest scores, year of undergraduate study, and undergraduate program were included in the model as control variables.

Out of all 45 predictors in the model, receptive vocabulary knowledge growth and silent reading rate growth both emerged as important predictors, ranking as the sixth and eight most important variables respectively. Increases in vocabulary knowledge and reading speed after language instruction were associated with higher GPAs in subsequent years of undergraduate study. These results represent two findings that are pertinent to applied research on the mental lexicon. Relative to other language measures, gains in the academic performance of EALs are strongly linked to (i) growth in lexical knowledge, and (ii) increases in the speed with which lexical information is extracted during an eye-movement fixation. Our results therefore point to prioritizing improving vocabulary knowledge and word recognition speed of EAL bridging program students.

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Title: Affective congruency in compound processing

Author: Jordan Gallant

Consider the compound *'hairball'*. According to ratings retrieved from the LADEC database (Gagné et al., 2019), both the modifier and head constituent are highly semantically transparent (*'hair'* = 0.94 out of l; *'ball'* = 0.91). However, according to valence ratings taken from the Warriner, Kuperman, and Brysbaert database (2013), the valence of the compound *'hairball'* is negative (valence 3; 1 = maximally negative; 9 = maximally positive), while the valence of both whole-word constituents is positive (*'hair'* = 6.18; *'ball'* = 6.14). Previous research has shown that the affective context in which a word appears influences the way it is stored and processed (Snefjella & Kuperman, 2016). In primed lexical decision, affective congruence between the prime and target facilitates word recognition (Hill and Kemp-Wheeler, 1989). In sentence reading, affective congruence between content words improves comprehension (Lüdtke and Jacobs, 2015). However, affective congruency in the domain of compound word processing has not yet been explored. This study examines the influence of affective congruency between a compound and its constituent using a constituent-prime lexical decision task.

The critical stimuli for both experiments were 108 English bi-constituent compounds. Affective congruence of constituents was estimated by taking the difference between whole word constituent and compound valence ratings. Modifiers and heads in the lower quartile range were categorized as incongruent-positive (I-P), indicating that constituent valence was more positive than that of the compound, those in the upper quartile were categorized as incongruent negative (I-N), and the remaining constituents were categorized as congruent (C). Critical stimuli were selected to ensure that an equal number of I-P, I-N, and C modifiers and heads were included. Non-word stimuli were pseudo-compounds constructed from compound constituents matched to the critical stimuli by family size, frequency, and valence. Stimuli were presented in three prime conditions: modifier (C1), head (C2), and control. All primes were lowercase, and all stimuli were uppercase. In both C1 and C2 conditions, an identity prime appeared for 75ms followed by a visual mask (e.g., '#####' 'blood' - '#####' - 'BLOODBATH'). Stimuli were presented in a Latin-square design so that prime conditions were balanced across experiment sessions. Responses from 57 participants were collected and analyzed using linear mixed-effects regression modeling. Results showed significant effects of head constituent affective congruency on both lexical decision RTS and accuracy but not no effect of modifier congruency. Compounds with I-P heads had slower RT than those with I-N or T heads regardless of modifier congruency. Both C1 and C2 priming conditions resulted in faster RTS compared to controls. However, no interaction between prime condition and affective congruency was observed.

The findings reported are interpreted as evidence of an affective congruency effect in compound processing. The origin of such effects are discussed as well as their implications for future research on compound processing. Discrepancies in RT for compounds with I-P and I-N constituents are discussed in relation to the positivity effect observed in visual word recognition studies (Kuperman et al., 2014). Future directions for research on affective congruence are also discussed.

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Platform Session 3.2

Title: Reading at one's finger tips: inferring reading proficiency from finger-tracking patterns
Authors: Alessandro Lento, Claudia Marzi, Andrea Nadalini, Vito Pirrelli and Marcello Ferro
Similarly to how eye-tracking (ET) captures eye fixations, "finger-tracking" (FT) can record the number and timing of touch events of a reader's finger pointing to a text displayed on a tablet touchscreen during reading. In spite of their different dynamic, eye and finger movements have recently been shown to strongly correlate in adults' reading [1]. Here, FT reading data of Italian adults and 2^{nd}—5^{th} graders are subjected to Recurrence Quantification Analysis (RQA)[2], a nonlinear method for data analysis that has been used to highlight behavioural and structural (chaotic vs. deterministic) differences in reading strategies [3, 4]. The analysis is applied to both silent and oral reading times of word tracking, and to the spatial x-y coordinates of finger touch events on the tablet screen for each group of readers (Figure 1). Results show that grade level and age play an important role in the organisation of the reading dynamic. In particular, adults and late graders' tracking movements are more structured and predictable than those of early graders, as shown by the significantly higher levels of determinism in their space/time touch patterns. The analysis provides evidence that the reading pace of proficient readers is steady and less affected by contingent features of the text, and this is strikingly reflected by readers' finger movement patterns both in time and space. A cross-RQA between ET and FT reading times data (not shown here) confirms this finding.

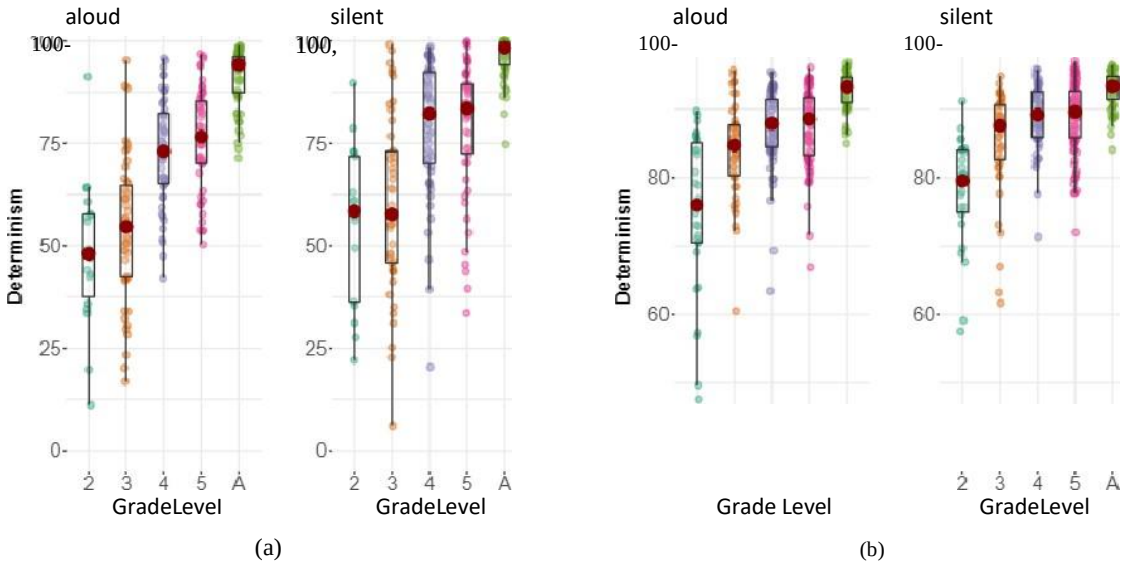

Figure 1: RQA determinism of finger-tracking patterns in time (a) and space (b), by grade level (A = adults).

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Title: Evidence for saccadic reading dynamic with finger-tracking speed rates

Authors: Andrea Nadalini, Marcello Ferro, Alessandro Lento, Vito Pirrelli and Claudia Marzi

Recent evidence showed that finger movements pointing to a text while reading on a tablet touchscreen approximate eye fixation time [1]. Despite the inherently continuous signal of finger tracking, as opposed to discrete ocular movements alternating fixations with saccades, here we present converging evidence from a group of 59 adults whose finger and eye movements were captured independently, while reading journalistic excerpts, either aloud or silently. Words that are more likely to be skipped by the eye for their functional role or shortness, are associated with higher and more stable finger-tracking speed than content and longer words. We thus discretized the finger speed trace of each text line by extracting every pair of speed valley immediately preceded by a speed peak. Such local "speed bursts" were then taken as analogues of eye fixations and assigned to words in the text by looking at their spatial coordinates on the tablet page (Figure 1). Eye movement patterns are known to differ between silent and oral reading, with the former being associated with shorter fixations and more skipped words, and the latter with longer fixations and fewer skipped words [2]. Crucially, the same pattern emerged also from the discretized speed trace of the finger. In addition, by comparing the probability for a word to be eye-fixated with the probability for the same word to be associated with a local burst in the finger speed trace, we observed a strong correlation (r= .63 & .68 in aloud and silent reading respectively, p-value <.001). Finally, a validation test (precision= .89, recall= .84, F1= .865) suggests that finger-tracking speed rates may be considered as a reliable predictor for the saccadic reading dynamic, and that the finger-tracking methodology can be used as an ecological proxy for eye-tracking in reading assessment.

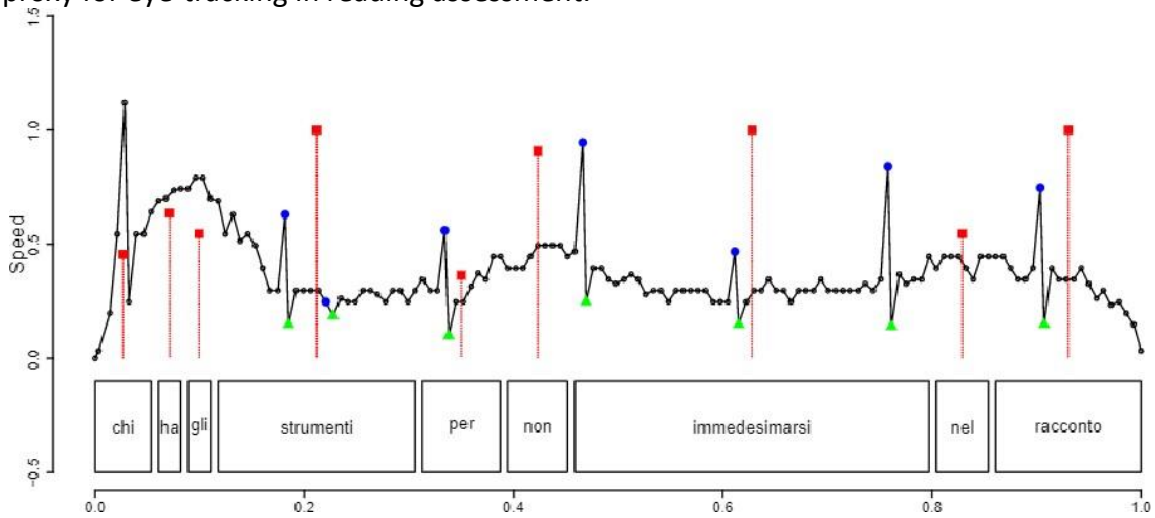

Figure 1: An individual finger speed trace for a single line of text. Red squares represent mean fixation probabilities taken from the eye tracking data for the same line. Blue dots mark local maxima (peaks) while green triangles local minima (valleys) in the finger speed signal.

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Title: When the root of 'barking' can access 'tree': Eye-tracking and maze evidence for the activation of ambiguous morphological roots in sentences

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How does the language comprehension system identify and interpret constituent morphemes during incremental processing? Upon reading *The dog was barking all night* one may construct a representation of the morphologically complex word *barking* that is quite constrained both syntactically viz., verb tense and aspect—and semantically, that is, interpreting *barking* as the noise that the dog was making. Notice, though, that the root bark has two possible interpretations. One that refers to how dogs cry, which can be used as a verb (*to bark*) or a noun (*a loud bark*), and another that refers to the outer shell of trees. Derivational and inflectional suffixes like *-ing*, however, should disambiguate between those two realizations, allowing for only the 'dog' meaning to be obtained in its diverse syntactic realizations (*the barking dog, the dog is barking, the barking of the dog*). In the present study we ask whether the affixation of a semantically ambiguous morphological root constrains access to its multiple meanings. In other words, does *barking* yield access to both the "dog" and "tree" meanings of the root *bark*?

We investigated this question employing eye-tracking (Experiment 1) and a maze paradigm (Experiment 2). In Experiment 1, participants read sentences containing words with semantically ambiguous roots such as barking combined with primes that yielded four sentence types, three containing semantic anomalies, and one a normal sentence of English. One prime target pair was presented with no semantic 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 the activation of both meanings of the ambiguous root, with gaze durations on both *tree* and *dog* being statistically similar. That is, even in cases where the morphological affixation (*bark-ing*) rules out a word consistent with the full form (*tree*), the ambiguous root activates both its meanings. These results were supported by Experiment 2, employing a maze task, without the anomalous conditions. In this task, participants (*N=96*) had to self-pace read the sentence word-by-word and to select, at a maze juncture, the word that best continued the sentence (e.g., *night*). Results showed that response times to select night were greater when the competitor word was *fail* (anomalous control), but there was no different between *tree* and *dog*. The lack of difference between the two competitors (*tree, dog*) related to the root of *barking*, suggests that the meanings of the ambiguous root lingered, possibly as an effect of early morphological decomposition of the prime.

Results from both experiments are consistent with the view that morphological parsing occurs online, yielding access to the meanings of morphemes regardless of their sentential and morphological contexts.