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# Abstracts for IWoLP online

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NOVEMBER 2021

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## Keynote talks

### **Connected speech: Insights from acute stroke**

**Tatiana SCHNUR (Baylor College of Medicine, USA)**

**November 2nd at 4pm CET / 11pm EDT / 8am PDT**

Left hemisphere brain damage often impairs language production demonstrating that an extensive left frontal-temporal parietal network is necessary to produce words in syntactically accurate structure. However, the processes for producing and organizing the content (i.e. words) into structure (lexical or syntactically accurate combinations) during connected speech localized within this left lateralized brain network have not been well identified. In this talk, I will present work relating patterns of brain damage with deficits in the content and structure of spontaneous connected speech in speakers during the acute stage of a left hemisphere stroke, and new work looking at longitudinal changes during the year after stroke. By examining lesion behavior relationships in a large group of speakers identified with radiological signs of left hemisphere acute stroke, we increased variability in behavioral performance, lesion size, and lesion location and avoided the confound of brain-behavior reorganization.

### **The many facets of language production in bilingual aphasia**

**Swathi KIRAN (Boston University, USA)**

**November 2nd at 5pm CET / 12pm EDT / 9am PDT**

In this talk, I will review recent evidence on language production in the context of bilingual aphasia. First I will provide an overview of bilingual aphasia by juxtaposing patterns of language loss with different patterns of recovery observed in the literature and discussing the role of language and cognitive control in both of these phenomena. Then, I will talk about the impact of pre-morbid language proficiency on lexical selection and language production in aphasia and the role of inhibitory control during language production. I will also review what errors in naming and language production can tell us about models of lexical selection and cognitive control in healthy bilinguals. Finally, I will summarize evidence from our own testing of these frameworks with bilinguals with aphasia.

### **Sociolinguistic variation as a window on language production**

**Meredith TAMMINGA (University of Pennsylvania, USA)**

**November 10th at 4pm CET / 10pm EDT / 7am PDT**

Sociolinguistics and psycholinguistics have been developing as independent research areas for decades, but recent years have seen an uptick of interest in their intersection. While this intersection contains a wide range of new questions, in this talk I will focus on how we can understand conversational data on intraspeaker variation, central to sociolinguistic research, as the output of complex language production processes. I will review recent work arguing that processing influences sociolinguistic outcomes in ways that can be detected even in conversational data, effects which in Tamminga, MacKenzie and Embick (2016) we termed “p-conditioning.” I will share some updates to my thinking about the role of p-conditioning in shaping sociolinguistic variation, with a special focus on the promise that this line of inquiry might hold for understanding language production more generally. Because the processes involved in producing sociolinguistic variation need to operate on linguistic units while also making reference to social context, we can harness the reflections those processes create in surface patterns of variation to learn more about both the representational nature of linguistic units and the integration of social information into language use.

**Moving language production experiments online: Challenges and solutions**  
**Amie FAIRS (Aix-Marseille Université), Anne VOGT (Humboldt-Universität Berlin) & Svetlana PINET (BCBL)**  
**November 10th at 5pm CET / 11pm EDT / 8am PDT**

With labs closing around the world due to the covid-19 pandemic, many psychology researchers were forced to take experiments online. This posed a problem for speech production researchers as previous to the pandemic almost no speech production research had been carried out online and hence it was unknown whether accurate, reliable, and similar production data could be collected via the internet. In this session, we will discuss different production paradigms (e.g., picture naming, word typing) the three of us have used, with remarkable success, to both validate data collected via the internet and to investigate new questions. We present the results of our studies, and pay particular attention to methodological challenges we faced and how we solved them. We hope for a lot of discussion about the benefits and challenges to moving research online.

**Do motor and rhythmic skills influence the development of written production?**  
**Eric LAMBERT (Université de Poitiers, FR)**  
**November 15th at 4pm CET / 10pm EDT / 7am PDT**

Numerous studies have shown that language abilities, and more specifically phonological abilities, are essential for learning written language, including written production development. But other non-language factors also influence this learning. In this talk, we will present studies that have shown that fine motor skills and rhythmic skills also impact written production development. While early studies showed an influence of these skills at the very beginning of learning, recent research has indicated that this influence persists throughout the learning process and may even still play a role in adults. These studies have used correlational methods, longitudinal methods, or interventions with training methods. Moreover, the different domains of written production -graphomotor processes, spelling, or text production- are not influenced in the same way to rhythmic and fine motor skills. Potential explanations will be presented for for these distinct contributions. In particular, we hypothesize that handwriting processes, but also executive functions may mediate the link between these two predictors and written language skills. To this end, we will present our work conducted in third-grade children on structural equation modeling.

**Age-related Similarities and Differences in Processing Phonological Information: Neural and Behavioral Evidence**  
**Michele DIAZ (The Pennsylvania State University, USA)**  
**November 15th at 5pm CET / 11pm EDT / 8am PDT**

Although decline in cognitive functions is often observed with aging, language functions show a pattern of both spared and impaired performance. Semantic knowledge is well maintained throughout adulthood, however older adults have increasing difficulty with language production. Older adults have slower speech, increased slips of the tongue, and exhibit more pauses and fillers during speech. Some have argued that age-related language production difficulties arise from phonological decline. While phonological impairments may be a key contributing factor to certain phenomena, such as tip-of-the-tongue states, the nature of phonological representation is less clear during typical production demands. To explore these issues, recent work from our lab has examined the neural and behavioral effects of word characteristics such as lexical frequency, neighborhood effects (phonological and semantic), and minimal pairs on picture naming in a broad sample of individuals across adulthood. While we observe typical age-related slowing, increases in errors, and increases in functional activation during picture naming, neural and behavioral sensitivity to word characteristics is

largely stable across the lifespan. These findings suggest that sensitivity to phonological and other word characteristics is stable across the lifespan, but access to and manipulation of that information may decline with age.

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## Short talk sessions

**Session 1 on November 2nd at 6pm CET / 1pm EDT / 10am PDT**  
**Psycholinguistics of word production, chaired by Alissa MELINGER (Dundee, UK)**

### **n° 11 - Cumulative semantic interference in social interaction – an online implementation**

Roger HAUBER

*Humboldt University Berlin*

Anna KUHLEN

*Humboldt University Berlin*

Rasha ABDEL RAHMAN

*Humboldt University Berlin*

Cumulative semantic interference (CSI) refers to a linear increase of naming latencies for pictures from the same semantic category (Howard et al., 2006). When naming pictures together with a task partner, CSI can also be elicited by the partner's naming (Kuhlen & Abdel Rahman, 2017; Hoedemaker et al., 2017), presumably because participants simulate their task partner's naming, therefore adding further to the linear increase within a category. Stark and colleagues (2021) have replicated the standard CSI effect (i.e. without a task partner) in an online setting relying on latencies from typed naming responses rather than from overt naming. In order to investigate further the nature of the partner elicited CSI, we have designed an online experimental setting that evokes a live, virtual social interaction. Participants are made to believe that they are participating in a picture-naming study together with another task partner. We piloted this setting (N = 12) and find that our implied social interaction was perceived as credible. We are now implementing this setting as an online experiment replicating the partner elicited CSI effect. In this experiment, participants and their supposed task partners will name a series of pictures by typing the corresponding word. The task partners' typing will be simulated by an animated symbol with a latency derived from previous studies. This measure aims to provide a constant reminder of the partner's supposed presence and task without introducing a semantic confound by writing out the partner's naming response. Five words of each semantic category will be typed by the participant, an additional five words will be typed by either the partner (Joint Naming condition) or nobody (Single Naming condition). We predict partner elicited semantic interference as reflected in an interaction of the linear increase of latencies within a given semantic category with the naming condition, i.e. a steeper increase in the Joint Naming condition. Upon successful replication of the partner elicited CSI effect in an online setting, further manipulations of the social context will be introduced. In this presentation, we will introduce the virtual social interaction setting and provide first results of the described experiment.

### **n° 12 - Language production in shared task settings: when (social) task context shifts semantic interference to facilitation**

Anna K KUHLEN

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Rasha ABDEL RAHMAN

*Department of Psychology, Humboldt-Universität zu Berlin, Berlin, Germany*

When performing joint actions, individual co-actors represent not only their own but also their task partner's action. These partner co-representations can interfere with own actions (e.g., Sebanz et al., 2003). Also in verbal tasks in which speakers jointly name pictures the partner's naming appears to be represented and can cause interference with the own naming response (e.g., Baus et al., 2014; Brehm et al., 2019; Gambi et al., 2015; Kuhlen et al., 2017). Yet the nature of the partner co-representation and its potential to cause interference with own lexical access is currently unclear (e.g., Hoedemaker & Meyer, 2019; Kuhlen & Abdel Rahman, 2021a). Here we present evidence that suggests the nature of the partner co-representation and its effects on own speaking may depend on the requirements of the task setting. In two experiments (Kuhlen & Abdel Rahman 2020, under review) a picture-word interference (PWI) task was embedded in a communicative game in which one partner named the distractor word and the other named the target picture. At a stimulus-onset-asynchrony (SOA) of -100ms, typically eliciting strong semantic interference effects in the PWI task, both experiments found no semantic interference. When identical auditory distractors and experimental parameters were entered into a single-subject setting, we replicated the classic semantic interference effect. What is more, at an SOA of -650ms we observed semantic facilitation when the communicative game prompted speakers to consider the conceptual relationship between distractor and target. We conclude that semantic interference can shift towards semantic facilitation in communicative settings that prompt speakers to relate their partner's utterances to their own. We are currently following up with a fourth experiment (data collection ongoing, preregistered under Kuhlen & Abdel Rahman, 2021b) to investigate whether also a non-communicative, single-subject setting that prompts a focus on the conceptual relationship between target and distractor can reduce semantic interference and strengthen semantic facilitation. Our experiments demonstrate the flexibility of language production to social, and possibly more generally task context, and are informative to theories of language production and accounts of language use in social interaction.

### **n° 13 - Name agreement affects processing of background information: the role of attention engagement**

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To communicate effectively, speakers must select a target word from multiple candidates based on a to-be-expressed concept. An important variable reflecting lexical selection difficulty is name agreement (NA): naming a low NA picture (e.g., sofa / couch) is slower than a high NA picture (e.g., banana) (Alario et al., 2004). How production difficulty, here indexed by name agreement, affects background information processing is under-studied. We compared the influence of name agreement on background information processing in cross-modal speaking-while-listening and unimodal speaking paradigms to show how speakers manage background information when focusing on their speech planning. Three studies used a multi-object naming paradigm in which accuracy, onset latency, utterance duration, total pause time, and response chunking were measured. The first two experiments explored how name agreement affected the processing of auditory background information with varied representational similarity and attention demands. In Experiment 1, Dutch speakers named pictures with high or low NA while ignoring Dutch speech (high similarity), Chinese speech (moderate similarity), or eight-talker babble (low similarity). In Experiment 2, Dutch speakers named pictures with high or low NA while either ignoring Dutch speech (focused-attention), or attending to them for a later memory test (divided-attention). Both representational similarity and attention demand effects occurred only for high NA pictures, which suggests that difficult lexical selection eliminates the effects on



auditory information processing. Experiment 3 tested how name agreement affected background information processing in unimodal speaking. Dutch speakers named pictures with orthogonally varied NA (high, low) and semantic context (homogeneous, heterogeneous). Here, name agreement and semantic context did not interact at all, suggesting that difficult lexical selection does not affect semantic context processing in speech production. Combined, these results highlight how successful speaking means not allowing auditory background information to intrude via an attention engagement mechanism (Halin et al., 2014): difficult planning requires speakers to concentrate harder, making their locus of attention more steadfast and causing them to process the auditory background information less. However, the attention engagement mechanism does not work in unimodal speaking.

#### **n° 14 - Factors affecting object naming performance in people who recovered from COVID-19**

Dasha SHAVARINA

*European Master's in Clinical Linguistics (EMCL)*

Coronavirus disease 2019 (COVID-19) has been shown to influence language performance (Almeria et al., 2020). While language performance in people who had COVID-19 has been evaluated with fluency tasks, naming has not been explored. Therefore, the current study investigates object naming, assessed by the Boston Naming Test (BNT, Allegri et al., 1997), in people who had COVID-19. This study has two objectives. The first is to determine whether individuals who recovered from COVID-19 are impaired in object naming. The second is to establish the demographic factors (e.g., age), COVID-19 symptoms (e.g., breathing difficulty, fatigue) and/or word properties (e.g., frequency, imageability, familiarity) that affect performance, as measured by the total number of correct words on the BNT. Eighty-four Spanish-speaking people who had COVID-19 were administered the Boston Naming Test. The proportion of people impaired in naming in the present sample was compared to the proportion expected in the general population using a proportion test. The effects of word properties, demographic factors, and COVID-19 symptoms on performance were assessed using a logistic regression. The proportion of people impaired in naming was significantly greater than the hypothesized proportion in the general population. Years of education, gender, age, fever, breathing difficulty, headache, subjective complaints, anxiety, depression, and number of days hospitalized predicted object naming performance. No word properties predicted performance. In conclusion, people who had COVID-19 were more impaired in object naming than the general population. Demographic and symptom factors, but not word properties affected their performance. The absence of word property effects may be due to the mild degree of a linguistic impairment, or an impairment of a non-linguistic nature. Alternative, more sensitive assessments, may ascertain the nature of the impairment. Allegri, R. F., Villavicencio, A. F., Taragano, F. E., Rymberg, S., Mangone, C. A., & Baumann, D. (1997). Spanish boston naming test norms. *The Clinical Neuropsychologist*, 11(4), 416–420.

Almeria, M., Cejudo, J. C., Sotoca, J., Deus, J., & Krupinski, J. (2020). Cognitive profile following COVID-19 infection: Clinical predictors leading to neuropsychological impairment. *Brain, Behavior, & Immunity - Health*, 9, 100163–100173.

#### **n° 15 - Semantic interference is not always blind to language: Evidence from Japanese-English bilinguals**

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Semantic interference (SI) is a well-documented effect occurring within speakers in which the naming of an item typically slows after naming another from the same semantic category (e.g., dog after horse) compared to an unrelated item (e.g., dog after violin). Past research demonstrated a carryover of SI across Catalan and Spanish languages in a continuous naming task (e.g., Runnqvist et al., 2012). This was interpreted as evidence that monolingual and bilingual speech production rely on similar mechanisms, allowing competition to occur between languages. However, Catalan and Spanish are closely related in surface form, and share a high proportion of cognate items. Focusing on Japanese-English bilinguals, we employed the blocked cyclic naming paradigm (BCN) in order to investigate whether the SI effect in bilingual production might carryover languages that differ in surface form. In our first Experiment, we successfully replicated the SI effect with 16 monolingual native speakers of English using a modified BCN procedure that included filler items between blocks. Significantly slower naming was observed for related than unrelated blocks from the second cycle onward that persisted across the filler items. In Experiment 2, using the same modified BCN paradigm, 16 Japanese-English bilingual speakers switched languages on a filler item between cycles 4 and 5. We observed significant increases in naming latencies in both related and unrelated blocks between cycles 4 and 5 as well as elimination of the SI effect, with performance on cycle 5 resembling that on the first cycle. The SI effect returned on subsequent cycles. These findings demonstrate that SI may only carryover between languages that are similar in surface form. In addition, they are inconsistent with a proposed conceptual origin for the SI effect in the blocked cyclic naming paradigm (cf., Belke, 2013), instead indicating both the origin and locus of the effect may be at the lexical level (e.g., Damian et al., 2001).

## **n° 16 - How the Past Affects the Present: An Examination of Use-Dependent, Error-Based Learning in Lexical Access**

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*Moss Rehabilitation Research Institute, Elkins Park, PA, USA*

Erica L MIDDLETON

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In the domain of lexical access, incremental learning has been most exhaustively studied as it relates to the manifestation of semantic interference, a phenomenon in which prior naming deleteriously affects current naming performance of a semantically related item. The present study tests assumptions of prominent accounts of incremental learning in lexical access, specifically whether semantic interference in lexical access is both (1) use-dependent—attempting a stage of mapping (e.g., from semantics to words during naming) provides input to learning; and (2) error-driven—competitor words that are more activated when a target word is retrieved receive greater inhibition. In the present design, for each of 30 persons with aphasia with naming impairment, we examined the influence of an immediately prior word repetition trial versus naming trial (i.e., prime trial) on current trial naming accuracy (i.e., target trial). Prime-target pairs involving word repetition versus naming for the prime trial are termed repetition-on-naming and naming-on-naming, respectively. Semantic similarity of prime-target pairs was free to vary. If semantic interference arises from error-driven incremental learning, greater semantic relatedness between a prime and target should decrease target trial naming accuracy. However, if incremental learning is additionally use-dependent, the effect of semantic relatedness of the prime trial on the target trial should be stronger when the prime trial involves naming compared to word repetition. Both predictions were confirmed. First, the observed prime-target semantic similarity effect (estimate = 4.44, SE = 1.57, Z = 2.83, p = .004) is supportive of error-driven learning. Furthermore, the presence of prime-target semantic similarity effect only in the naming-on-naming condition (estimate = -2.27, SE = 1.01, Z = -2.25, p = .02) indicates an inherent relationship between the

use-dependence and error-driven aspect of incremental learning. Additionally, the effect of semantic similarity on target trial response accuracy did not differ as a function of whether the prime trial involved successful versus unsuccessful naming (estimate = 2.20, SE = 2.38, Z = 0.92, p = .35), suggesting the retrieval attempt (not success) is sufficient for conferring semantic interference. The present study advances our understanding of the nature of the learning mechanism that underpins semantic interference effects in lexical access.

## **n° 17 - Picture Naming in Diglossic Aphasia**

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Although almost all languages have dialects, few psycholinguistic studies of dialect processing and production exist (cf. Melinger, 2018; Vorwerg, 2019). More, while bilingual aphasia is gaining increased interest in research (Gray & Kiran, 2018), for diglossic aphasia there have been virtually no studies so far (Widmer Beierlein, 2020). Diglossia is the use of a dialect and a standard variety in different sociopragmatic contexts (Haas, 2004). In Switzerland for example, dialect is the first language of most Swiss, and is preferred in oral communication, enjoys a high prestige and is hardly written, compared to the standard variety. The latter is used in formal settings like schools and exams. The following study investigates the influence of diglossia on speech production of persons with aphasia (PWA) and of a control group (CG) in a picture naming experiment. We investigated whether there is a difference in correctness and/or naming latency (NL) between dialect and standard variety and whether quantitative and/or qualitative differences of language variety errors exist between individuals with aphasia and the control group. Language variety errors are defined by the choice of the wrong variety used either with the correct or an incorrect word. We studied 33 PWA and a aged matched CG of equal size. Each person named 128 words (64 in dialect, 64 in the standard

variety). The CG shows significantly higher correctness in both varieties compared to PWA [ $p < .001$ ]. No significant effect of speech variety was found for correctness. Regarding NL, the CG has significantly lower NL than PWA [ $p < .001$ ]. There is a significant interaction effect between variety and group [ $p = .007$ ] in as such that the CG names significantly faster in dialect compared to the standard variety. PWA however show lower NL in the standard variety compared to the dialect. Also, PWA switch more often to the non-desired variety than the CG. The results for the PWA show an unexpected preference for the standard variety, which could – among other reasons – be due to higher activation threshold because of additional activation via the visual system. Further language processing studies with other dialects are needed, also in order to improve aphasia therapy conditions.

## **n° 18 - The lexical representation of compounds is not affected by age: Evidence from continuous picture naming**

Anna-Lisa DÖRING

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Rasha ABDEL RAHMAN

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Pienie ZWITSERLOOD

*Westfälische Wilhelms-Universität Münster*

Antje LORENZ

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While some models assume that only the compound's own lemma is active during compound production (e.g., Levelt et al., 1999), others argue for multiple active representations, namely the compound's constituent lemmas in addition to the holistic compound lemma (e.g., Marelli et al., 2012). Whereas data from picture-word interference or determiner-priming studies mostly support the former view (e.g., Lorenz et al., 2018, Lüttmann et al., 2011), we recently provided evidence for a multiple-lemma representation of compounds in a continuous picture-naming study (Döring et al., in press). In this study, young adult speakers named objects from different semantic categories (e.g., animals). Previous studies have shown that naming latencies within categories increase with each additionally named member. This cumulative semantic interference (CSI) is interpreted as increasing interference during lexical selection (e.g., Howard et al., 2006). In our materials, category membership was established through the compounds' first constituents (animals: zebra crossing, pony tail, cat litter . . .), while the compounds themselves were not semantically related. Moreover, pictures depicting the compounds' first constituents (zebra, pony, cat . . .) served as baseline for semantic interference. Naming latencies in this condition increased within categories, replicating the well-documented CSI effect. Importantly, CSI was also observed during compound naming, which indicates that the lemmas of the compounds' first constituents were activated during compound production, causing interference due to their semantic relationship, and thereby hampering the production of the whole compound. To test whether the multiple-lemma activation observed in young speakers changes with age, as a function of learning and exposure (for data from comprehension, see Duñabeitia et al., 2009; Reifegerste et al., 2016), we conducted the same continuous picture naming experiment with a group of older speakers (aged 60+ years). Preliminary results are similar to those of young adult speakers (Döring et al., in press). We observed cumulative interference in the control as well as the compound condition, suggesting that the semantic relationship between the compounds' first constituents influenced compound production in older speakers, just as it did in younger speakers. Consequently, our data shows that the multiple-lemma representation of compounds in speech production is stable across the lifespan.

**Session 3 on November 2nd at 6pm CET / 1pm EDT / 10am PDT**  
**Written, embodied, interactive word production, chaired by F.-Xavier ALARIO**  
**(Marseille, FR)**

**n° 21 - Lexical and syntactic influences on syntactic encoding in written language production by deaf speakers**

Zhenguang CAI

*The Chinese University of Hong Kong*

Nan ZHAO

*Hong Kong Baptist University*

Hao LIN

*Shanghai International Studies University*

*Introduction.* Much research has shown that, in speaking, syntactic encoding is, among other things, driven by prior syntactic experience and lexical characteristics (e.g., structural preferences of the verb). In hearing speakers, there is much theoretical ground to assume that, writing employs largely the same syntactic encoding processes used for speaking. What is much less clear is how deaf speakers syntactically encode words into a structure in writing, given that they have no access to a spoken language. Using the structural priming paradigm, this study investigated syntactic and lexical influences on syntactic encoding in writing by deaf speakers of Chinese in comparison with hearing controls.

*Experiments.* Experiment 1 showed that deaf speakers tended to re-use a prior syntactic structure (double-object vs. prepositional-object datives) in written sentence production (i.e., structural priming) to the same extent as hearing speakers did; in addition, such a tendency was enhanced when the target sentence repeated the verb from the prime sentence (i.e., lexical boost) in both deaf and hearing speakers to the same extent. These results suggest that deaf and hearing speakers are similarly affected by syntactic and lexical factors in syntactic encoding in writing. Experiment 2 revealed comparable boosts in structural priming for prime-target pairs with homographic homophone verbs and for prime-target pairs with heterographic homophone verbs in hearing speakers, but a boost for prime-target pairs with homographic homophone verbs but not for pairs with heterographic homophone verbs in deaf speakers.

*Conclusion.* These results suggest that while syntactic encoding in writing is influenced by lemma associations developed for homophones as a result of phonological identity in hearing speakers, it is influenced by lemma associations developed for homographs as a result of orthographic identity in deaf speakers. In all, syntactic encoding in writing seems to employ the same syntactic and lexical representations in hearing and deaf speakers, though lexical representations are shaped more by orthography than phonology in deaf speakers.

**n° 22 - Cascadedness in Chinese spoken word production**

Anonymous

*None declared*

Years of research established the limited cascadedness in spoken word production. Several recent Chinese studies, however, reported that the Chinese word production system is mainly discrete (i.e., no phonological activation of non-target words). This raises the question of whether the effect of phonological activation of non-target words in Chinese could have been absent or too weak to observe. Morsella & Miozzo is a picture-picture interference (PPI) study that strongly supports the phonological activation of non-target words in English. They overlaid distractor pictures on target pictures: when the distractor pictures were phonologically related to the target words, reaction time was shorter. The PPI paradigm has not been attempted in Chinese. Our design contrasted three types of distractors: (1) exact homophone, where a target

and its distractor have identical lexical tone and syllable; (2) simple homophone, where only the syllables are identical; (3) phonologically unrelated. The exact homophone distractors could increase the likelihood of observing phonological activation of the distractors. Alternatively, exact homophone distractors could have stronger lexical competition with the target, leading to a longer reaction time. Data were collected from 31 native Mandarin Chinese speakers online. There are three pieces of evidence supporting the phonological activation of the distractors. Firstly, a higher semantic relatedness rating translates into a longer reaction time; this influence of semantic relatedness is weaker in the Exact Homophone Condition, suggesting the effect of distractor phonology (p-values < 0.007). Secondly, a cluster of participants (n = 10) shows the phonological activation of the exact homophone distractors: the Exact Homophone Condition is responded faster than the other two conditions (p-values < 0.001). Thirdly, a cluster of participants (n = 3) shows the phonological activation of the simple homophone distractors: the Simple Homophone Condition is responded faster than the other two conditions (p-values < 0.001). Our results are most parsimoniously explained by a cascaded production system, where lexical tone mediates homophony, and exact homophone distractors induce stronger phonological facilitation than simple homophone distractors. An individual participant's result is modulated by the relative strength of the distractors' influence on either lexical selection or form preparation.

### **n° 23 - Typing to the Beat of Inner speech: The Embodied Representation of Speech Prosody in Keystroke Rhythmic Patterns**

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Theories of embodied linguistics offer a model for the relationship between linguistic representation, experience, and brain activity. The correlation of brain activation patterns with referential features of words suggests that the mechanism underlying linguistic embodiment is an 'action-perception simulation'. This is harder to adapt to non-lexical aspects of language that are crucial for communication, such as syntax, pragmatics, and emotion. Prosody has a major role in expressing these aspects of language. Thus, we propose that prosody serves as a sensory-motor phenomenon that can evoke an action-perception simulation of such non-lexical aspects of language. We hypothesized that prosody has an essential role in the embodiment of the non-lexical aspects of the sentence, hence temporal patterns associated with prosody will be reflected in related motor activities. Specifically, we hypothesized that the acoustic pattern would predict typing patterns. In two experiments designed to test this hypothesis, participants listened to sentences, repeated them in covert speech, and then typed them at their own pace. Both experiments manipulated the pragmatic aspect of speech manner (direct/indirect). In addition, one experiment manipulated emotional prosody (angry/neutral/happy) and the second manipulated syntactic prosody (question/statement), while temporal patterns of keystrokes were measured. Results revealed that the audio duration was a significant predictor for inter key intervals in in both experiments, both as an independent predictor and in interaction with word number, indicating that participants' typing rhythm is highly associated with rhythmic aspects of the acoustic speech stimulus. These findings highlight the relationship between the motor system and language production system suggesting that inner speech serves as a simulation that guides typing rhythms, hence they support the notion of inner speech as linguistic embodiment of sentential prosody. These findings have significant theoretical implications for embodiment theories because they reflect simulation of the non-lexical aspects of speech which are expressed in prosodic patterns.

**n° 24 - Phonological neighbourhood effects in picture naming: A case for interactivity within and across languages in late bilinguals.**

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Introduction Speakers who acquire a second language later in life must integrate new representations in their lexicon. These representations co-exist with those of the native language, with which they may share some degree of form similarity (phonological neighbours). We explored the extent to which the degree of activation of phonological neighbours affects the ease with which a bilingual can access and produce spoken words. We hypothesised that this activation is a function of a) the frequency status of the target relative to its neighbours, and b) the individual's exposure to the L2.

Methods 50 late French-English bilinguals with a range of English exposure named 318 pictures in English. Analysis using (G)LME included target phonological neighbourhood density (PND: English, French, and combined - three separate models), target translation equivalent similarity (cognateness), participant years of English exposure, and as control predictors: imageability, name agreement, familiarity, trial order, preceding trial RT.

Results RT: Significant interactions were found between PND and 1) target familiarity ( $X^2(1)=10.16$ ,  $p=.001$ ), and 2) exposure ( $X^2(1)=6.07$ ,  $p=.014$ ): High PND had an inhibitory effect on low familiarity targets but this effect was reversed for high familiarity targets; PND effects were stronger in speakers with lowest exposure to English. There was also a significant interaction between cognateness and exposure ( $X^2(1)=5.47$ ,  $p=.019$ ) - the cognateness benefit reduced as English exposure increased. Accuracy: There was a significant facilitatory effect of exposure ( $X^2(1)=13.83$ ,  $p<.001$ ) and an interaction between PND and familiarity ( $X^2(1)=16.57$ ,  $p<.001$ ), with again an inhibitory effect of PND for low familiarity targets, that was reversed for high familiarity targets. For both RT and accuracy, all PND measures showed the effects, but model fit was greatest for French (i.e., cross-language) and combined English-French, compared to English (within-language) PND.

Conclusion Results can be best accommodated within models with interactivity between the lexical level and the phoneme level, and activation and interactivity within and across languages of a bilingual. We extend the weaker links hypothesis (Gollan et al., 2008), by suggesting language exposure can be equated to frequency status of words in a bilingual, and explaining the effects arising as a consequence of interactivity between levels of processing within and across languages.

**n° 25 - Web-based Language Production Experiments: Semantic Interference Assessment is Robust for Spoken and Typed Response Modalities**

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For experimental research on language production, temporal precision and high quality of the recorded audio-files are mandatory. These requirements are a considerable challenge if language production is to be investigated online. However, online research has a huge potential regarding efficiency, ecological validity and diversity of study-populations in psycholinguistic and related research, also beyond the current situation. Here, we supply confirmatory evidence that language production can be investigated online and demonstrate that written naming responses (using the participants' computer keyboards) are a reliable and efficient alternative to typical overt spoken responses. To assess semantic interference effects in both modalities we performed two pre-registered experiments (n=30 each) in online settings using the participants' web-browsers. A cumulative semantic interference (CSI) paradigm was employed that required naming several exemplars of semantic categories within a seemingly unrelated sequence of objects. Reaction time (RT) is expected to increase linearly for each additional exemplar of a category. In experiment 1, CSI effects in naming times described in lab-based studies were replicated. In experiment 2, the responses were typed on participants' computer keyboards and the first correct key press was used for RT analysis. This novel response assessment yielded a qualitatively similar, very robust CSI effect. Besides technical ease of application, collecting typewritten responses and automatic data preprocessing substantially reduce the work load for language production research. Results of both experiments open new perspectives for research on RT-effects in language experiments across a wide range of contexts. JavaScript- and R-based implementations for data collection and processing are made available for download.

## **n° 26 - Concepts in the Space: The Effects of Spatial Diversity and Direction on Conceptual Retrieval**

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From the perspective of embodied cognition, space is at the heart of the human conceptual system and we often think in spatial metaphors. For example, distance is a spatial concept but found to be intimately involved in related effects such as emotional distance (attenuated affect), temporal distance (e.g., discounting



effects), and social distance (e.g., hierarchies and social class). Most traditional accounts, on the other hand, view concepts as an encapsulated system of arbitrary, abstract, and amodal representations, which cannot explain the interactions between our conceptual representations and spatial relations. Informed by theories of embodied cognition, in the present study, we designed a novel priming technique to investigate the impact of spatial diversity and script direction on conceptual processing. First, participants connected a target dot to either one other dot (One-to-One condition), or many other dots (One-to-Many condition), and either from left to right (Rightward condition) or from right to left (Leftward condition) on a computer touchscreen using their dominant hand's index finger. They were then asked to generate as many words as they can given the initial syllables of 12 Persian words. We predicted that greater spatial diversity (One-to-Many condition) and consistency with Persian directionality (Leftward condition) should induce greater conceptual diversity (i.e., more word productions). This is because under an embodied account, spatial diversity and directionality in the physical space should facilitate lexical retrieval in the semantic space. Sixty native Persian speakers took part in the experiment. The participants were given 20 seconds to generate words for the given prompts. The results showed a better word generation performance for the One-to-Many conditions relative to the One-to-One conditions, especially when the participants connected the dots from right to left (Leftward condition), suggesting that searching through semantic memory is facilitated with greater spatial diversity and with script direction consistency. This pattern of results suggests that people might rely on spatial relations for word retrieval within semantic memory, and lend empirical support to the embodied cognition framework according to which spatial relations play a crucial role in the conceptual system.

## **n° 27 - A developmental perspective on pause location during text production**

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The aim of this paper is to examine where pauses occur during text production. One underlying assumption of studying pausing during writing is that increased pause time reflects an increased cognitive effort for the writer (cf. Spelman Miller 2006b). Previous studies have repeatedly found a high frequency of pausing between larger syntactic units (paragraphs, sentences and clauses) (cf. Matsuhashi 1981; Ailhaud et al. 2016), and this has been connected to planning and reading the written text. The present compares the pause locations between L1 writers of different ages, in order to further discuss how pausing behaviour can shed light on both writing development and language acquisition, with the working hypothesis that pauses would be particularly frequent in linguistic contexts that the writer is developing at the moment.

Data consists of 136 computer-written expository texts by 136 Swedish participants from five age-groups: 10-year-olds, 13-year-olds, 15-year-olds, 17-year-olds and adult university students. The writing process was recorded by means of keylogging, which makes it possible to afterwards study the on-line processes during writing (Lindgren & Sullivan 2019). Around 15 000 pauses longer than 2 s were analysed regarding pause location following Spelman Miller's (2006a) suggestion to code for the preceding context.

The results revealed significant age effects regarding how the age groups distributed the pause time. The 10-year-olds had the largest proportion pause time within-words, indicating that spelling is an issue for this group. The 13- and 15-year-olds had a comparable higher proportion of pausing in clause boundaries, indicating writing fluency, and a linearity where one sentence is added after the other. The 17-year-olds typically had higher pause proportion within clauses, and in connection with adding phrases, suggesting that creating a higher density in the texts required additional effort. Finally, the 17-year-olds and the adults had a higher pause proportion in connection with revisions, where the adults especially engaged in global editing of their texts.

The findings suggest that the reason for pausing vary depending on the writer's age. The developmental pattern may reveal both a linguistic development (e.g. that 17-year-olds expand their texts with additional phrases), and a developed understanding of the potential of written production (e.g. the possibility to edit the text).

**Session 2 on November 10th at 6pm CET / 12pm EDT / 9am PDT**  
**Cognitive neuroscience of word production, chaired by F.-Xavier ALARIO (Marseille, FR)**

**n° 31 - Investigating the functional relevance of cortical key nodes for action picture naming**

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Previous neuroimaging and neurostimulation work suggests that the left ventral premotor cortex (vPMC) and the left intraparietal sulcus (IPS) play key roles in action understanding, particularly in relation to tool and object use in action words. However, their roles in intransitive actions (i.e. actions that do not involve objects) are less clear. In an experiment employing Transcranial Magnetic Stimulation (TMS), we explore the involvement of two cortical regions in intransitive action picture naming. In this experiment, twenty participants named intransitive action pictures (e.g. LAUGH), accompanied by repetitive TMS to the left vPMC, left IPS, and right superior parietal lobe (SPL; acting as control site). TMS was applied at 10Hz for 400ms, starting simultaneously with picture presentation. Within each session, ten intransitive pictures were presented 40 times each (400 trials per session, 200 for active TMS and 200 for sham). Three sessions were conducted on separate days, one per targeted region (vPMC, IPS, SPL). We expected that TMS applied to the vPMC would lead to delayed naming times of intransitive action pictures, but IPS stimulation would produce no effect on naming latencies. Through Generalized Linear Mixed Modelling, we found that naming latencies were significantly slower following active vPMC stimulation, as compared to sham and control site (SPL). There was no significant effect of active IPS stimulation on naming latencies. These results suggest that the vPMC may be involved in intransitive action picture naming, but the specific mechanism that operates in this region is unclear.

**n° 32 - Neural oscillation of interference control in the aging brain: evidence from spoken word production**

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Speaking is not only about retrieving words and structuring them into sentences, but it also requires top-down control to plan and execute speech. In previous electrophysiological research with young-adult speakers,

mid-frontal theta oscillations have been observed using a picture-word interference paradigm. With this paradigm, participants name picture while ignoring superimposed distractor words. In particular, mid-frontal theta power increases for categorically related distractors relative to other types of distractors, reflecting the top-down interference control in resolving the competition between processing streams during word production (e.g., Piai, Roelofs, Jensen, Schoffelen, & Bonnefond, 2014). In the present study, we conceptually replicated the magnetoencephalography study by Piai et al. (2014) with an older group of healthy adults with an average age of 60. Behaviorally, we replicated distractor interference effects usually observed in young adults, that is, faster naming in congruent (e.g., naming apple when seeing the distractor word “apple”) than in related (picture apple, distractor “banana”) conditions (i.e., Stroop-like interference), and faster naming in unrelated (picture apple, distractor “bike”) than in related conditions (i.e., semantic interference). However, we did not find the corresponding theta modulation of these interference effects on the neural level. Instead, we found beta power decreases for both interference effects, mostly pronounced in the left posterior temporal and inferior parietal cortex. The distinct spectral-spatial-temporal profile of the oscillatory effects in the older population suggests different underlying dynamics relative to the midline frontal effect previously found in young-adult speakers. Our results indicate that the neural underpinnings of top-down interference control may be modified by aging, and that the mid-frontal theta cannot be the exclusive mechanism enabling interference control during spoken word production.

### **n° 33 - Concurrent Semantic Priming and Lexical Interference for Close Semantic Relations in Blocked-Cyclic Picture Naming: Electrophysiological Signatures**

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In the present study, we employed event-related brain potentials to investigate effects of semantic similarity on different planning stages during language production. We manipulated semantic similarity by controlling feature overlap within taxonomical hierarchies. In a blocked-cyclic naming task, participants ( $N = 24$ ) named pictures in repeated cycles, blocked in semantically close, distant, or unrelated conditions. Articulation-related artifacts in the electrophysiological data were corrected by employing residue iteration decomposition (RIDE). Linear mixed effects models were separately run for the analyses of the first and later cycles based on our specific hypotheses that semantic blocking effects would arise in different directions. Only closely related items, but not distantly related items, induced semantic blocking effects. In the first presentation cycle, naming was facilitated (relative to unrelated blocks), and amplitude modulations in the N1 component around 140-180ms post-stimulus onset at posterior sites predicted this behavioral facilitation. In contrast, in later cycles, naming was delayed, and a negative-going posterior amplitude modulation around 250-350ms post-stimulus onset predicted this interference. Based on the cognitive processes typically associated with these components, this pattern of results suggests easier object recognition or identification may underlie initial facilitation of picture naming, while lexical selection processes may underlie interference. The N1 modulation was reduced, but persisted in later cycles in which interference dominated, and the posterior

negativity was also present in the first presentation cycle in which facilitation dominated, demonstrating concurrent effects of conceptual priming and lexical interference in all naming cycles. Our assumptions about the functional role these two opposing forces play in producing semantic context effects is further supported by the finding that the joint modulation of these two ERPs on naming latency exclusively emerged when naming closely related, but not unrelated items. The current findings demonstrate that close taxonomic relations, but not distant taxonomic relations, induce strong semantic blocking effects, and that concurrently active electrophysiological signatures reflect a trade-off between facilitatory priming and interfering lexical competition.

#### **n° 34 - Considerations for interpreting chronometric TMS studies investigating language production**

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Based on a comprehensive meta-analysis, Indefrey & Levelt (2004) provided spatial and temporal correlates to the various stages of word production as described in the model by Levelt and colleagues (Levelt et al., 1999). Specifically, lemma retrieval occurs in the left mid portion of the middle temporal gyrus (MTG) from 200-275ms; phonological code retrieval in the left posterior middle/superior temporal gyri (STG) from 275-355ms; and syllabification in the left posterior inferior frontal gyrus (IFG) from 355-455ms. Over the years, chronometric TMS studies have been conducted in attempts to test these temporal and spatial estimates. The present study aimed to carry out a modified replication of one of these chronometric TMS studies, namely that of Schuhmann et al. (2012). Participants received triple-pulse TMS to one of three stimulation sites (posterior MTG, posterior STG & IFG) in one of five time-windows (225-275; 300-350; 375-425; 450-500; 525-575 relative to picture onset) as well as a No-TMS condition while they named pictures. The study comprised two sessions, one in which pictures with monosyllabic names were used and the other with bisyllabic names. We found that IFG stimulation around 450-500ms post-stimulus onset significantly delays naming latencies during monosyllabic naming, while not significantly disrupting bisyllabic naming. pMTG stimulation in the 450-500ms time-window delayed monosyllabic naming while facilitating bisyllabic naming at 225-350ms. pSTG slowed monosyllabic naming when stimulated at 375-425ms and at 450-500ms during bisyllabic naming. However, throughout testing it became obvious that some participants were naming pictures faster than others, which is problematic given the assumption of a relatively fixed mean naming latency underlying the choice of stimulation time-windows. For this reason, we also performed a response-locked analysis to better control for variability in individual naming latencies. Across both analyses, only IFG seems to show some consistency in effects around 400-500ms post-stimulus onset. With the lack of consistency across sessions and analyses, we call into question the validity of our results and provide a detailed discussion on the

methodological confounds that need to be overcome in our own as well as other chronometric TMS studies before theoretical conclusion can be drawn from such studies.

### **n° 35 - Speech and non-speech motor encoding from childhood to adulthood**

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When planning speech, an abstract phonological code must be transformed into a motor code (motor planning/programming) in order for articulation to be possible. It has been suggested that the speech motor plans become motor routines following intensive speech training (i.e., after thousands of hours of speaking). In this study, we are interested in the development of speech motor planning/programming and, in particular, in addressing the question of when speech motor plans become routines. This routinization of speech gestures should take place gradually between the moment the child has the capacity to produce all the phonemes of his language (around 6-7 years) and adulthood, where motor speech routines seem to be actively in use (e.g., Levelt's Mental Syllabary, 1989 or Guenther's Speech Sound Map, 2006). We explored this question by contrasting the production of speech, including both words and non-words, and the production of sounded non-speech gestures, which use the same effectors as speech but which are not as intensively trained. Participants consisted of 15 children (aged 7 to 9) and 16 adults (aged 20 to 30) who underwent a delayed production task with articulatory suppression during EEG recording. We predict that in children speech routines are not set up yet, thus, the production of speech and non-speech should not differ, contrarily to what is observed in adults (Lancheros et al., 2020), where routines are supposedly established for speech only. Preliminary results show that children are less precise when producing non-words as compared to non-speech, while virtually no differences are observed in adults' accuracy. For production latencies, children's word productions are faster than both non-words and non-speech, while adults are only faster in words as compared to non-speech. The analysis of response locked ERP data showed a time window of differences between words and non-speech relatively close to the vocal onset in children. Differences across conditions in adults are observed in an earlier time window and they are more extended than in children. They also involve a different time distribution of stable global electrophysiological patterns. These preliminary findings only partially confirm our predictions, leaving open the question of whether the storing of motor routines of speech items composed of highly frequent syllables is already established in children.

### **n° 36 - What makes the middle temporal gyrus so special in language production?**

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The middle temporal gyrus (MTG), especially in the left hemisphere, has received a lot of attention among us, language production aficionados. You may recall in particular the bright yellow spot in the mid-section of the left MTG in Indefrey and Levelt's 2004 brain model of language production (see also Indefrey, 2011). These meta-analyses proposed that this region plays a central role in lemma retrieval and selection starting at around 190 ms post-stimulus onset. This putative role of the left MTG is supported by neuropsychological studies focusing on individuals with stroke-induced aphasia, as individuals with lesions encompassing this area have been shown to have difficulties with lexical access in language production and comprehension paradigms (e.g., Dronkers et al., 2004; Baldo et al., 2014). However, it is unclear whether or not the left MTG is also involved in other aspects of language production or if it is simply silent after it has . . . said its word (pun intended!). We present intracranial electroencephalography data gathered in multiple picture naming paradigms showing that the MTG (left and right) is in fact not silent after its initial early stimulus-locked engagement. Contrasting erroneous to accurate verbal responses across multiple subjects during picture-naming reveals larger local field potentials in bilateral MTG in errors than correct trials peaking around vocal onset, in parallel with similar results in the dorsal anterior cingulate cortex. A similar pattern is seen around 250 ms post-vocal onset in the MTG, in parallel with similar results in the superior temporal gyrus (STG). In addition, this response-locked activity in the MTG appears larger in semantically homogeneous compared to heterogeneous contexts. These results show that the MTG is re-engaged at the time of motor output, and suggest the reactivation of lexical representations during speech monitoring. This reactivation may play an important role in supporting inner speech monitoring in conjunction with the medial frontal conflict monitoring system, and outer speech monitoring in conjunction with the perception-based monitor in the STG. All in all, the MTG may be even more special than we initially thought as it is engaged at multiple times throughout distinct stages of language production.

### **n° 37 - fMRI evidence for shared lemma representations in speech production and comprehension**

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Lemma representations are thought to map the meaning of words to their sounds and vice-versa (Levelt et al., 1999). There is evidence using different methodologies that suggests that lemmas are localised in the middle portion of the left middle temporal gyrus (Indefrey & Levelt, 2004). However, according to another view, sound to meaning mapping occurs bilaterally in the posterior inferior and middle temporal gyri (Hickok & Poeppel, 2007). No previous study has attempted to use neuroimaging to find evidence for lemmas being shared across production and comprehension and for their localisation in the brain. We conducted an fMRI study with four tasks that comprised two modalities (speech production and comprehension) and targeted different levels of representation (phonological, conceptual, syntactic) to which the lemma connects. We found common activation across all four tasks in the middle part of left middle temporal gyrus as well as in the left posterior inferior temporal gyrus and in bilateral posterior middle temporal gyrus, regardless of the modality and the targeted level of representation. This evidence supports theories that claim lemma representations underlie both production and comprehension, and it supports both claims regarding the localisation of lemmas.

### **n° 38 - Distinct neural mechanisms support different forms of inner speech, a registered report**

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Inner speech production is often accompanied by a multisensory experience with auditory and kinaesthetic percepts. The cognitive and neural mechanisms generating these percepts are still debated. According to a prominent proposal, inner speech has at least two distinct phenomenological facets: inner speaking and inner hearing. These two phenomenologically distinct processes may be supported by distinct cerebral mechanisms. More precisely, we hypothesise that inner speaking relies more strongly on an (online) motor-to-sensory simulation to reconstruct a multisensory experience, whereas inner hearing relies more strongly on a memory-retrieval process, where the multisensory experience is reconstructed from stored motor-to-sensory associations. In this registered report, we will use single-pulse transcranial magnetic stimulation (spTMS) in 30 healthy participants to assess whether inner speaking and inner hearing are indeed supported by distinct cerebral mechanisms. We predict that the speech motor system will be more involved by inner speaking than by inner hearing, measurable as an increase in lip corticomotor excitability (i.e., larger motor evoked potentials). Further, the greater involvement of the speech motor system during inner speaking is predicted to be effector-specific, with rounded linguistic items (e.g., /ba/) increasing lip corticomotor excitability more than spread linguistic items (e.g., /ki/).

**Session 4 on November 10th at 6pm CET / 12pm EDT / 9am PDT**  
**Audience design and sentence processing, chaired by Alissa MELINGER**  
**(Dundee, UK)**

**n° 41 - Differences in Prosody Parallel to Syntactic Structure in Turkish**

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A crucial step in determining the meaning of a sentence is identifying the grammatical roles of the phrases and mapping thematic roles onto them. There are (at least) five types of cues that could potentially facilitate sentence processing: propositional content, discourse context, overt case-marking, word order, and prosody. We investigated whether the way people produce spoken utterances depends on the consistency, reliability and robustness of these cues. To date, most research on spoken language production and processing has been done on languages like English that have relatively strict word order and impoverished morphology with little research on languages with flexible word order and rich morphology. The research presented in this thesis addresses this gap by investigating the production of spoken Turkish, a language with flexible word order and rich morphology. In Turkish, sentences that have scrambled word order or lack overt object case-marking are temporarily ambiguous (i.e., garden-path sentences). We had nine Turkish speakers read aloud SOV sentences (i.e., sentences with default word order) and OVS sentences (i.e., sentences with scrambled word order) that did or did not have overt object casemarking. We found that there were prosodic differences between casemarked and noncasemarked sentences and between scrambled and non-scrambled sentences. These findings suggest that Turkish speakers prosodically mark grammatical roles when morphosyntactic cues like word order and case-marking are absent. We discuss some possible linguistic, psycholinguistic and information theoretic reasons for the observed prosodic differences, and outline future studies that could distinguish among these accounts.

**n° 42 - Speakers take referent predictability into account, but not necessarily to aid the listener**

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Language use is commonly considered a joint activity, in which speakers and listeners take each other's perspective to ensure correct transmission of the message (e.g. Clark, 1996). Psycholinguistic research suggests, however, that there are limits to when and how perspective taking takes place (e.g. Kronmüller & Guerra, 2020). In this study, I investigated to what degree speakers take their listeners into account when telling stories.

Listeners are continuously making predictions about what will be mentioned next (e.g. Altmann & Kamide, 1999). If speakers take these predictions into account, one would expect that they try to be extra clear when they are going to say something less predictable (cf. Arnold, 2008). Conversely, speakers do not need to be as clear when the listener already knows what they are about to say. If speakers are specifically taking their addressee's perspective, they should make such adjustments more in the presence of an actual addressee.

To test these hypotheses, I conducted a language production experiment in which participants produced spoken continuations of narrative fragments. Half of the participants performed the task without anyone else being present, while the other half told the stories to another person, who had to pick out the correct depiction. The fragments were created to invoke strong predictions: for example, the fragment "First, the queen mocked the activist. Next, ..." is expected to continue with something else the queen did. However, the fragments were accompanied by pictures that made clear how the story continued. In half of the cases,



the story actually continued with the unpredicted character (e.g. the activist in the above example). Based on the results of a pretest, I calculated a surprisal score for each character in each narrative, as a measure of its predictability. I predicted that as surprisal increases, speakers would refer more clearly to the target character in their continuations, for example by repeating the NP instead of using a pronoun (e.g. “Next, the activist/she walked away”).

The results indeed show the predicted pattern. However, it did not matter whether the speaker was telling the stories to an actual addressee or not. Speakers already considered the referent’s predictability when no addressee was present. Therefore, it remains unclear whether the predictability effect is related to speakers aiding listeners, or whether it arises from speakers’ own production preferences.

### **n° 43 - Greater Entropy Leads to more Explicit Referential Forms during Language Production**

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Speakers have a choice as to how to refer to previously-mentioned words (e.g., the teacher); they can use attenuated referring expressions such as pronouns (he or she), or more elaborated referential forms such as repeating the original word in full (the teacher). Predictability is theorized to influence form of reference during language production; with more attenuated forms used to refer to more predictable words. This is presumably because highly predictable words are highly active in the speakers’ (and comprehenders’) memory, and therefore require less linguistic signal to be encoded. However, the reported results are mixed with some studies showing that more predictable words tend to be subsequently realized with less explicit referring forms, and some studies showing no effect of predictability on referential forms. These mixed results might arise from the way in which predictability is measured. The current paper argues that the relevant cognitive processes during reference production are best captured by examining the re-mention probability of both, rather than just one, referential candidate. To this end, data from multiple previous experiments (number of participants = 492, number of critical items = 720), was pooled to examine the potential effect of information entropy, which quantifies the amount of overall uncertainty associated with next mention, on the form of referring expressions. The results revealed a reliable effect of entropy, with greater entropy leading to a greater probability of using more explicit referring forms. Interestingly, the effects of cloze probability and surprisal, both of which quantify the predictability of single referential candidates, did not turn out to be statistically significant when entropy was included in the model. These results suggest the greater uncertainty regarding next mention leads to greater competition between the referential candidates, reducing the overall memory activation for both, and therefore strengthening the probability of using more explicit forms of reference.

### **n° 44 - Support for a novel, simple method for calculating word frequency of output on language production tasks**

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Introduction: Studies consistently report that patients with schizophrenia exhibit qualitative abnormalities on language production tasks. These abnormalities are possibly associated with the severity of psychotic

symptoms. Despite this, some studies have conflictingly suggested that patients with schizophrenia exhibit similar word frequency (WF) effects on lexical tasks compared to healthy subjects. Given that previous studies calculated WFs from language corpora, we aimed to investigate the relationship between WF and psychotic symptoms using a novel, simple method for calculating WF. Methods: Thirty-six patients with schizophrenia were included in the study. The severity of positive symptoms was measured using the Scale for the Assessment of Positive Symptoms (SAPS). One semantic and one letter fluency task were administered with the patients instructed to produce as many animal names and words beginning with the letter p in 60 s, respectively. Every response in the output was assigned (1) a corpus-based WF, extracted from the German-language lexical database dlexDB, and (2) a within-sample WF. The within-sample WF was calculated as the raw number of participants who produced the word. Spearman's correlations were computed between the WF variables and symptoms. Results: Corpus-based WF exhibited skewed, kurtic, and/or non-normal distribution. Contrastingly, within-sample WF displayed normal, non-skewed, and non-kurtic distribution. There were no significant correlations between corpus-based WF and symptoms on both tasks. Conversely, within-sample WF on semantic fluency was significantly negatively and weakly correlated with the global SAPS score, as well as subscales measuring delusions and bizarre behavior. Further, within-sample WF on letter fluency was significantly positively and weakly correlated with the subscale measuring bizarre behavior of the SAPS scale. Conclusion: The differences in the data distribution patterns between corpus-based WF and within-sample WF indicate that different methodological frameworks may have better use of one or the other variable type. Further, significant correlations with positive symptoms were observed only for within-sample WF. It can be concluded that within-sample WF may be more appropriate for analyzing verbal fluency output in psychiatric research compared to corpus-based WF.

#### **n° 45 - Graph structure analysis of speech production among college-aged second language learners**

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Language experience shapes the gradual maturation of speech production, both in the native (L1) and second (L2) languages. The present study set off to investigate whether graph structure analysis could reveal any distinctions between L1 and L2 speaking. More specifically, it aimed to address the relationship between graph structure (short and long-range recurrences) and second language learners' oral production in L1 and L2. Seventy-five college-aged students who were native speakers of English and received classroom instruction in L2-Spanish participated in this study. Proficiency measures in the two languages were generated using three tasks (i.e., picture description, phonemic fluency, and semantic fluency) and operationalized in each case as the number of words per minute. In order to carry out the graph analysis with the computational tool SpeechGraphs, each speech sample was represented as a graph (each word as a node and the sequence represented as arrows or directed edges). This method was originally created to characterize formal thought disorders in clinical populations (MOTA et al., 2014), but more recently, it has also been applied to map speech connectedness in monolingual (MOTA et al., 2016; 2018) and bilingual children (LEMKE et al., submitted). Results show significant negative correlations between graph attributes (short-range recurrences)

and speech measures, but only for the participants' L2 (Spanish). These findings indicate that producing a larger number of short-range recurrences, instead of long-range ones, may be a marker of the initial stages of L2 oral development. These findings are consistent with the pattern reported in the early stages of L1 literacy (MOTA et al., 2016; 2018). Future studies should further explore the interactions between the graph structure and second language speaking, including more advanced stages of L2 learning and considering the role of cognitive abilities in this process.

#### **n° 46 - Paradigmatic and syntagmatic influences on Estonian spontaneous speech production**

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Recent research suggests that both word-internal and word-external morphological structures influence acoustic durations of words and segments. Word-internal structures are concerned with the internal composition of words. For example, in English, several studies have reported systematic durational differences between morphemic and non-morphemic word final /-s/ (e.g., Plag et al., 2017; Seyfarth et al., 2018). Word-external morphological structures concern relations to other words within a morphological family. It has been shown paradigmatic neighbours get activated when words are produced (see e.g., Lõo et al. 2018). However, these effects have usually been studied in laboratory context using words in isolation (but see Cohen, 2015). Also the majority of such research has been conducted in morphologically simple languages (see Strycharczuk, 2019 for an overview). Thus, not much is known about how these effects emerge in spontaneous speech production, in particular in morphologically rich languages, such as Estonian.

Following previous work on English (Plag et al. 2017), the current corpus analysis focused on inflected (e.g., auto-s 'car, inessive singular') and uninflected (ratas 'wheel, nominative singular') word-final /-s/ content words from the Phonetic Corpus of Estonian Spontaneous Speech (Lippus et al. 2020). We analysed both the word durations as well as word final /-s/ segment durations using generalized additive mixed effects models (Wood et al. 2017). We report that conditional probability (the likelihood of a particular word given the next word) decreased both segment and word durations. In addition, inflectional paradigm size (the number of realized forms given an inflectional paradigm) co-determined the phonetic characteristics of words and segments under investigation. Unlike in the work by Plag and colleagues, the inflectional function (inflected vs uninflected) did not show any effects on the word and on segment duration. However, on the segmental level, conditional probability interacted with the inflectional function, being only significant for inflected forms. Thus, the current study emphasizes the importance of using morphologically rich and lesser studied languages in the investigation of morphological effects in speech production, and suggests that morphology is one part of a complex language production system.

#### **n° 47 - Human/animal contrast in patient independently motivates passive production across Japanese dialects**

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## Introduction

In Japanese, an event where a lower entity in animacy acts on a higher one is usually described using a passive sentence (Shibatani 2006; Kuno 1979). However, little is known whether the animacy of either agent or patient can individually contribute to passive production. In the literature of Japanese sentence production, animacy was manipulated with the contrast between animate and inanimate (Montag et al. 2017; Tanaka et al. 2011) or between a human being and an animal (Hidaka 2002, 2016a, 2016b). However, the latter contrast was not well evaluated since only one pair of items was used. Hidaka (2002, 2016a, 2016b) showed that Eastern dialects speakers produced more passives than Western dialects speakers, suggesting that animacy and structural preference is unevenly linked across Japanese dialects. However, more items are necessary to reveal the replicability of such cross-dialectal difference.

## Methods

We conducted a picture description task in Tokyo, Tohoku (Eastern region) and Kansai (Western region). We used combinations of humans and animals to manipulate the agents' and patients' animacy in the 10 transitive events to be described such that there were four conditions: human + human, human + animal, animal + human, and animal + animal.

## Results

Bayesian mixed effects logistic models were fit. Bayes factors indicate anecdotal evidence for the agent animacy effect ( $\beta = -0.89, BF = 2.12$ ), very strong evidence for the patient animacy effect ( $\beta = 1.85, BF = 75.23$ ), and anecdotal evidence for the interaction of the agent and patient ( $\beta = -0.95, BF = 1.75$ ). When the patient was a human being, more passives were produced. Moreover, human + human condition elicited more passives than animal + animal condition. Consequently, the patient's animacy alone can motivate passive production, rather than relative animacy difference. However, anecdotal evidence against the region effect ( $\beta_1 = 0.11, BF = 0.41$ ,  $\beta_2 = 0.19, BF = 0.46$ ) was found, suggesting that the regions no affected the passive choice, contrary to Hidaka's (2002, 2016a, 2016b) claims.

## Conclusion

Human/animal distinction affects the voice choice, even though these two can both be classified as animate. The patient's animacy independently influences voice selection. This contrasts with Shibatani (2006) and Kuno (1979), who argued that the relative animacy difference between the entities mattered. Furthermore, our results were consistent across Japanese dialects we examined.

## **n° 48 - ¿Are sentences pre-planned or incrementally produced by persons with aphasia (PWA)?**

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Whether sentences are planned in advance to speech onset or speakers plan just the necessary to initiate speech and then incrementally “time-share” planning and articulation is being debated [1, 2]. The few available studies in different populations [1, 2, 3, 4] report mixed results, possibly due to methodologies (e.g., summing, reading, discourse production) [2, 3, 4] that fail to control over complex processes. The only existing study with PWA [1] reported speakers' reliance on an incremental strategy for structurally simple sentences unlike for transitive and unaccusative sentences, where pre-planning occurred. Unfortunately, the PWA group was non-fluent and naming-impaired, making comparisons with controls problematic given that they required the production of visually presented objects in experiment 1 and PWA's non-fluency might have influenced their speech onset times (SOTs) in their two experiments. The goal of the current study

is to cast further light on sentence planning in PWA and the mechanisms that support it by using a novel task that parametrically manipulates sentence complexity. We tested speakers with mild conduction aphasia (N=4) equated with controls (N=6) in lexical, naming and comprehension abilities in a structured task where participants described the location of a primed simple geometrical shape. Complexity was increased across three blocks by adding features to the shapes (e.g. “The (dotted) (blue) circle is below the (crossed) (red) square”). If PWA had a planning deficit related to incremental processing, we’d expect equal SOT differences between groups in all blocks. Contrarily, if sentences were pre-planned, within group differences in SOTs would emerge between blocks, as more complex sentences would require more planning. Higher durations for PWA would indicate more intrasentential pausing, an index of lexical retrieval; lower accuracies would point to lexical selection alterations. Differences in SOTs arose in all blocks equally, with no block differences within any group. Response durations also varied in all blocks, while accuracies only differed in blocks 2 and 3. Results support incremental processing in PWA: SOTs were delayed regardless sentence complexity. PWA’s longer durations indicate lexical retrieval difficulties [5]. A more in-depth analysis of pausing patterns is underway to clarify this issue. Finally, accuracy differences in most complex sentences show lexical selection impairments for these sentences.

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