

Independent vs. shared syllable-representations in late Spanish-German bilinguals

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Speakers' ability to speak fluently might rely on stored high-frequency (HF) syllables. Stored motor programs for syllables facilitate speech planning relative to a slower segment-by-segment assembly used to construct novel or low-frequency (LF) syllables. Evidence for stored syllables comes from studies showing that HF-syllables are produced faster than LF-syllables (Cholin, Dell, & Levelt, 2011; Laganaro & Alario, 2006). Most previous work focused on monolingual speakers. A study by Alario, [1]Goslin, Michel, & Laganaro (2010) investigated syllable-frequency effects in early and late high-proficiency Spanish-French bilinguals. Their findings indicate that early bilinguals access independent language-specific syllabic representations when speaking their respective languages, while late bilinguals seem to rely on language shared representations. To further investigate the (dis-)entanglement of syllabic representations in bilingual speech, we tested syllable-frequency effects in late Spanish-German bilinguals of varying proficiency in German.

Using rigorously constructed materials controlling for segmental and metrical factors, participants produced German HF- and LF-syllables in a symbol-associating production task (Cholin et al., 2011). Language dominance was evaluated through self-assessment which proved all participants to be Spanish dominant.

The results revealed a significant interaction between Syllable Frequency and Language Dominance: Less proficient speakers of German showed an inverse syllable-frequency effect (HF-syllables yielding slower RTs than LF-syllables) while speakers with a higher proficiency level showed no RT-difference (with a trend towards a facilitatory syllable-frequency effect). The participants may have relied on Spanish syllable representations when producing German syllables. Post-hoc analyses, taking Spanish-to-German syllable correspondences into account, suggest that Spanish syllable frequencies may have impacted production times in German.

Against the background of the Alario et al. data, our results suggest that late bilinguals with a lower proficiency level in German may rely on Spanish syllable representations to construct German syllables anew before they gradually acquire language-specific representations.

Language control in production y comprehension: Are good language-switch producers also good language-switch comprehenders?

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Even though proficient bilinguals are remarkable at frequently switching between languages (i.e., code-switching), previous research suggests that code-switching requires measurable effort and involves switch costs in both production (see Declerck & Philipp, 2015 for review) and comprehension (e.g., Altarriba, Kroll, Sholl, & Rayner; 1996). Given this, it may be that at least some language control mechanisms are shared across production and comprehension. To test this, we measured switch costs in production using a mixed-language read-aloud task (Gollan & Goldrick, 2016, 2018; Gollan, Schotter, Gomez, Murillo, & Rayner, 2014; Gollan, Stasenko, Li, & Salmon, 2017; Kolers, 1966), whereby frequent intruders spontaneously translated printed words more frequently (e.g., Spanish-English bilinguals saying “pero” instead of “but”). Then independently, we measured eye movements during silent reading of English sentences that (sometimes) included a Spanish target word, while manipulating target word predictability. The number of intrusion errors made during the read-aloud task did not predict switch-costs during silent reading, suggesting that language control in production and comprehension are mostly governed by modality-specific control mechanisms. The one exception was with skipping rates, such that speakers who frequently produced intrusions also skipped predictable other-language targets more than unpredictable ones, suggesting that stages of comprehension that are more susceptible to top-down control (decisions to skip) may involve production-relevant control mechanisms.

Measuring the interaction of semantic processes and articulatory complexity in healthy adults

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Word production is a complex skill that requires the integration of several neural organizations for language and speech motor control (Kent 2004). Research have shown that these processes are highly interactive. However, interactions between language and speech functions remains underspecified in language production theories, specifically word production models underspecify speech motor control and emphasize on the different linguistic levels (semantics, phonology), whilst the speech motor control models underspecify linguistic processing (Levelt et al 1999; Van der Merwe 1997). In this research, we investigate the interaction of semantic processes (by manipulating the semantic activation by using non-cyclical blocked picture naming paradigm) and articulatory complexity (by varying the phonetic complexity of the words) in 30 young and 30 old healthy adults.

To fill this gap in the literature, this investigation implemented a non-cyclical blocked naming paradigm where participants were required to name a series of pictures in two semantic contexts: homogenous and heterogeneous. There were 10 homogenous sets and 10 heterogeneous sets with each set constructed in such a way to have 10 exemplars with 5 of them being considered as phonetically simple and the other 5 as phonetically complex based on the *Index of Phonetic Complexity*. Variables that were of interest were word duration to measure motor control and reaction time to measure word processing. ANOVA results revealed that when younger and older adults were compared there is an interaction of age and complexity in naming reaction time due to the older adults showing a larger effect of complexity. In the reaction time analysis, a main effect of age, blocking, and complexity was present but no interaction, with older adults requiring more time to respond. These results suggest that as age increases, one's ability to processes language and produce words declines.

Some syntactic deficits in dyslexia are independent of phonological deficits

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Dyslexic children and adults show syntactic deficits such as impaired agreement comprehension (Rispen, Been, & Zwarts, 2006; Rüsseler, Becker, Johannes, & Münte, 2007), poor awareness and production errors associated with morphology (Chung, Ho, Chan, Tsang, & Lee, 2013; Joanisse, Manis, Keating, & Seidenberg, 2000), and others.

This paper addresses the question of whether syntactic difficulties in dyslexia are related to the well-known phonological limitations thought to underlay the reading problems (Snowling, 1991) or are independent of them. We looked at production of subject-verb agreement errors in sentences with subjects containing a second “attractor” noun (e.g., “the owner(s) of the house(s) *is/are* away”). In the general population, these attraction errors are not straightforwardly dependent on the presence or absence of morphophonological plural markers but rather on their syntactic function and configuration. The same would be expected for dyslexic children if their syntactic problems are not phonological in nature. We also looked at the possible effect of system overload on syntactic processing by comparing auditory and written presentation of stimuli, and stimuli with high and low frequency attractors.

Dyslexic children produced significantly more agreement errors than age-matched controls, but their errors were distributed in the same manner and did not align with the presence of morphophonological number markings. Furthermore, there was no effect of either presentation mode or attractor frequency on the number of agreement errors. Our results confirm the existence of syntactic difficulties in (at least some cases of) dyslexia, and suggest that they are independent of other known problems (phonological deficit or verbal working memory limitations). Furthermore, these syntactic problems appear to be more a question of degree than of substance.

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Effects of verb position on sentence planning

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To produce sentences, speakers must retrieve words and produce them in a suitable order. Here, we test how sentence planning is affected both by the position of the verb in sentences with three different sentence structures (intransitive, transitive and ditransitive sentences) and by the lexical status of the main verb (word vs. pseudoword).

20 adult, eye-tracked Dutch native speakers produced sentences to describe visual arrays with 3 objects (random ordering of a square, triangle and circle) with a predetermined sentence type: “The triangle, the square and the circle [verb]” (intransitive), “The triangle and the square [verb] the circle” (transitive), and “The triangle [verb] the square to the circle” (ditransitive). The target verb was displayed at the top of the screen (the “verb region”), and was either a Dutch verb or a pseudoword. The factors Sentence type and Verb type were crossed in a counterbalanced design (6 conditions, 36 items each, divided into 36 mini-blocks).

Verb type influenced sentence onsets and articulation durations: both were longer in sentences with pseudowords than words. Moreover, articulation durations for ditransitive sentences were longer than for the other types, particularly if including pseudowords. Importantly, eye movements showed strong linear planning effects: speakers fixated the shapes and the verb in the order of mention. Fixations to the verb region at the beginning of a trial were longer when the verb was a pseudoword than a word, but verb lexicality exerted a stronger effect on planning in later time windows: speakers fixated the verb region earlier and longer in the case of pseudowords, resulting in longer delays in the onset of fixations to the post-verb shape in ditransitive than transitive sentences. The results suggest that properties of individual words (like the verb) exert an influence on sentence planning primarily in time windows immediately preceding their mention.

High lexical selection demands when switching into L1 versus switching into L2

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When bilingual speakers switch between their languages, they rely on their language control system. It has previously been found that switching from first (L1) into second language (L2) creates increased demand on different brain areas compared to switching from L2 into L1: namely response selection areas when switching from L2 to L1, and attentional and monitoring brain areas when switching from L1 to L2. This finding predicts that only switching into L1, not into L2, is demanding in terms of lexical selection and should therefore interact with lexical selection demands.

We investigated bilingual speakers' lexical retrieval performance when switching between their two languages and under a low versus high lexical selection demand. We manipulated lexical selection demand by asking participants to repeatedly name small sets of pictures from the same semantic category (homogeneous context) or from different semantic categories (heterogeneous context). It is known that naming pictures in a homogeneous condition leads to slower responses than naming pictures in a heterogeneous condition due to higher lexical selection competition. A group of 46 Arabic[L1]-English[L2] bilinguals named pictures alternating between their languages. When switching into a language, participants either named a new set of pictures (i.e. different items cross-linguistically) or the same set of pictures (i.e. same items cross-linguistically). We predicted that switching into L1 would be particularly hard in a situation of high lexical selection demand, especially when compared to switching into L2.

Consistent with previous research, a homogeneous context generally led to slower responses than a heterogeneous context. When participants switched between their languages, a homogeneous condition slowed down naming more when switching into L1 than when switching into L2. This finding was independent of whether participants started to name a new set of pictures when switching languages or kept naming the same set of pictures. However, the effect was bigger when they kept naming the same set of pictures. In this condition, the higher lexical selection demand of the homogeneous condition appeared to have interacted with the higher lexical selection demand of switching into L1. Taken together, our results provide further evidence for the claim that switching into L1 as compared to L2 is demanding in terms of lexical selection.

Endogenous or exogenous? Testing competition accounts of name agreement effects in picture naming with event-related potentials

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Pictures can be named in multiple ways. Name agreement is an empirical measure of how often people produce a picture's dominant name in picture naming norms. It correlates strongly with naming latencies (Alario et al., 2004), and produces robust effects in neuroimaging (Kan & Thompson-Schill, 2004) and ERPs (Cheng et al., 2010; Shao et al., 2014; Valente et al., 2014) that are almost invariably taken to reflect endogenous competition between alternative lexical entries for a given picture.

However, we have recently shown that people name pictures with strong alternatives faster than name-agreement-matched pictures with weaker alternatives (Oppenheim, in prep.) and can develop stable preferences for non-dominant names (Balatsou, Fischer-Baum, & Oppenheim, in prep.). Interestingly, studies manipulating picture–name agreement often include a pre-experiment familiarisation phase, requiring participants to name pictures using their norm-assessed dominant names. If speakers have previously established a preference for an alternative name, as we have shown, then such familiarisation creates a general task demand to override that preference. This would disproportionately affect low-agreement pictures, because fewer participants would spontaneously volunteer their dominant names, and this may account for some effects attributed to endogenous competition.

Here, we measured naming latencies and electrophysiological activity as participants named high- and low-agreement pictures before and after familiarisation. Crucially, we used each participant's initial naming preferences to select desired names for their familiarisation: half of the pictures were familiarised using the name they initially produced, and the other half were familiarised with an alternative. We thus deconfounded name agreement from the demands inherent to name switching. The initially strong effect of name agreement largely dissipated after familiarisation, replaced by a name switching cost. Preliminary analyses associate these two effects with distinct ERP patterns, suggesting that differences previously considered as evidence for endogenous competition may instead reflect the process of overriding one's naming preferences.

Errors and time courses in spoken versus written production

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The study of speech errors has been a highly successful method of examining the cognitive mechanisms that underlie language production. To date, the majority of this research has focused on errors during spoken production, and significantly less is known about the processes that underlie written production. Here we present a novel research paradigm that allows for the comparison of spoken and written errors during real-time language production. Specifically, we are interested in the rates at which units at various levels of representations are involved in errors across modalities, to determine which units are shared, and which are likely to be separate. Furthermore, we look at the sources of errors to compare the planning scope in the different output conditions. Finally, we also present data looking at the timing of output using a locus-of-slack analysis to examine sentence planning.

Participants were asked to provide sentences describing pairs of black and white drawings of simple events either verbally or in writing. The image pairs were presented simultaneously, followed by a box on the left or right side of the screen to indicate which image should be described first. Overall results showed more errors were produced in writing than speaking. A further breakdown showed more contextual errors were produced when writing than speaking (72% vs. 52%). The majority of contextual errors in writing came from within the word, but for speech, the majority of contextual errors were between words. Finally, writing contained more anticipation errors than preservation errors (66% vs. 34%), but the opposite pattern was seen in speaking (57% preservation vs. 43% anticipation).

We suggest that the greater number of anticipation errors and contextual errors in writing may be a result of individual's greater ability to plan ahead when writing due to the slower speed of output, causing greater interference with production.

Persistent changes reduce error in semantic-to-lexical mappings: Cumulative semantic interference in a three-session norming study

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Is vocabulary static with only ephemeral changes in activations (e.g. Roelofs, 2018), or is it continually affected by long-lasting experience-driven change (e.g. Oppenheim, Dell, & Schwartz's, 2010)?

We've claimed the latter (e.g. Oppenheim et al.'s, 2010, Dark Side model), and that cumulative semantic interference in picture naming shows evidence of real-time vocabulary development. Incremental error-based learning reduces activation error by reinforcing target connections and weakening competing connections. We've previously shown that cumulative semantic interference emerges even in picture naming norms (Oppenheim, in prep), and that speakers maintain their preferred names for pictures when re-naming them one week later (Balatsou, Fischer-Baum, & Oppenheim, in prep).

Here, we assess progressive changes in picture name consistency and cumulative semantic interference as speakers name the same 525 pictures three times over a three-week interval. Logistic mixed effects regressions show that name consistency progressively and persistently increases across these very long lag repetitions, supporting the Dark Side model's prediction that error-based changes in semantic-to-lexical mappings should persistently reduce lexical activation error. According to the Dark Side model's claim that cumulative semantic interference results from error-proportional learning, such reductions in activation error should also reduce the slope of the cumulative semantic interference effect, and linear mixed effects regressions of picture naming latencies confirm this prediction.

Compound production in aphasia: Contributions of semantic transparency and imageability

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The meaning of compound words can be more or less predictable from their constituents, e.g., “meatball” (transparent compound), “strawberry” (partially opaque compound) or “hogwash (opaque compound, e.g., Libben, 2014). Researchers have suggested that compound processing involves identifying the constituent words first, and attempting to integrate their meaning at a second stage (e.g., Ji et al., 2011). Because the meaning of the compound as a whole is activated in parallel, non-transparency in the constituent to compound relationship entails a conflict between the meaning that is stored and that which is computed online, incurring a processing cost. This phenomenon, which arguably cuts across lexical and conceptual semantics, is relevant for people with aphasia (PWA), who typically experience difficulties accessing and manipulating semantic information. We investigated the role of transparency in compound production (i.e., reading aloud) in PWA, and compare their performance with Healthy Adults (HA). Participants were 11 PWA (single left CVA, fluent and nonfluent) and 17 age- and education-matched HA monolingual British English individuals. Stimuli consisted of 90 items divided in three categories: transparent compounds, opaque compounds, and monomorphemic words (Ji et al., 2011). Participants were required to read aloud the words when they appeared on a laptop screen, with a 5-second timeout. Reading accuracy was calculated for both groups; RTs were only considered for the HAs. HAs processed compounds faster and more accurately than matched monomorphemes. However, no differences emerged as a function of transparency. In the PWA group, there was no difference between monomorphemes and transparent compounds, but both were processed more accurately than opaque compounds. A transparency effect (i.e., difference in performance between opaque and transparent compounds) correlated positively with imageability effects (i.e., difference in performance between high and low imageability words on background testing) for PWA. In a further analysis, we included transparency and imageability as continuous variables. The direction of the effects did not change, but imageability positively correlated with accuracy in both groups, and with shorter RTs in the HA. These results suggest semantic transparency effects in compound processing are modulated by the imageability of these words, an interaction which lies at the interface between lexical and conceptual semantics.

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Delayed picture naming in a second language

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Previous studies have shown that second language (L2) speakers are slower during speech production than first language (L1) speakers (Gollan, Montoya, Cera, & Sandoval, 2008; Lagrou, Hartsuiker, & Duyck, 2011). According to some accounts, this is due to a delay in lexical retrieval (Gollan et al., 2008). However, more recent studies found evidence that the delay is situated at the post-phonological stage (Broos, Duyck, & Hartsuiker, in press; Hanulova, Davidson, & Indefrey, 2011). The current study used the delayed-picture naming paradigm in order to see whether articulation itself is slower in L2 than in L1. An additional question was whether phonological complexity of the picture names would influence reaction times in either task. Forty-three Dutch-English unbalanced bilinguals and forty English monolinguals were asked to perform both a regular picture naming task and a delayed picture naming task in English (bilinguals and monolinguals) and Dutch (only monolinguals). During the delayed picture naming task, participants were told to withhold pronunciation until a cue appeared on the screen. Lexical retrieval and speech planning is therefore finalized before pronunciation, meaning that only speed of articulation is measured. Speakers were slower when naming the picture in L2 during the regular picture naming task but not in the delayed condition. Phonological complexity did not affect response latencies. Proficiency, however, did show an effect in that more proficient speakers were faster in the regular and delayed picture naming task. We conclude that L2 articulation in itself is not significantly slower but that the L2 delay is situated at the articulatory preparation stage of speech production.

Plasticity and transfer in the language system:

Exposure to syllables in perception changes their subsequent production

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According to a dominant hypothesis in psycholinguistic research ([1]), the production of frequent syllables relies on stored syllable-sized abstract motor commands. In line with this so-called “mental syllabary” hypothesis, several studies reported that speakers need less time to encode frequent than infrequent syllables. In a recent study, [2] further found that the neural networks involved in the production of high versus low-frequency and novel syllables differs shortly before the onset of articulation, a difference expected if high-frequency syllables require the retrieval of stored syllable-size motor programs whereas low frequency and novel syllables require that these programs be assembled on-line. Building on this finding, the present study investigates whether the phonetic encoding of syllables can be modified by training. It compares the influence of overt production training and auditory exposure. Nineteen participants were trained on high frequency, low frequency, and novel syllables in either a perception task (phoneme monitoring) or a production task (reading aloud) during two days. On the third day, participants named disyllabic pseudowords while their electroencephalogram was recorded. The first syllable of these pseudowords had either been trained in the perception task, trained in the production task or had not been trained. Overt production training and auditory exposure both decreased the production latencies at test, for all syllable types. Amplitude and topographic analyses revealed an interaction between syllable type and training. The EEG signal differed between high frequency and novel syllables but only for untrained syllables. Frequent and novel syllables no longer differed after production training or auditory exposure. These results will be discussed in the light of existing assumptions regarding the phonetic encoding process and the interface between the production and perception systems.

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Role of white matter lesions in cerebral small vessel disease:

A voxel-based lesion symptom mapping study of language production.

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White matter lesions (WML) are one of the neuroimaging hallmarks of cerebral small vessel disease (CSVD). The debilitating effect of WMH on cognition of people with CSVD is not clearly understood. Moreover, little is known about language functioning in this population. Previous studies suggested that the location of the WML may explain cognitive symptoms better than WML volume. Yet, these studies were either based on patients with mixed dementia diagnosis, on the genetic variant of CSVD, or had small sample sizes. The present study investigates the relation between WML locations and language production by using voxel-based lesion symptom mapping (VLSM) in a cohort of 443 CSVD patients without dementia. The Stroop (color naming, word reading and color-word naming) and the verbal fluency tests were used as measures of language production with varying degrees of executive demands. In addition, the digit symbol substitution test, which does not require word production, was also used to help disentangle the relationships between lesion and cognitive symptoms more broadly. All test scores were converted to standardized scores corrected for age, gender and education. All VLSM analyses were corrected for lesion size.

We showed that, in the digit symbol substitution test, lower scores were associated with WML predominantly in the right superior corona radiata and right caudate nucleus. Concerning the production tasks, lower scores on color-word naming and color naming were significantly associated with WML predominantly in the right superior corona radiata and left caudate nucleus. WML in the caudate nucleus bilaterally was significantly associated with lower scores in the word reading task. Lower scores on verbal fluency were associated with WML in the left caudate nucleus. Our results suggest an important role for the (left) caudate nucleus in word production tasks and further support the hypothesis that lesion location is an important factor for understanding cognitive symptoms in CSVD. This study shows, for the first time, that not only corona radiata but, also the caudate nucleus is an important location that relates to the clinical features of CSVD.

Cumulative semantic interference effects in school-age children

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Cumulative semantic interference (CSI) in naming is well documented in adults: Responding becomes slower across successive items within a semantic set, even when unrelated items intervene (e.g., Howard et al., 2006; Schnur, 2014). Current interpretations attribute the interference to learning or changes in connection weights within the lexical system (Howard et al., 2006; Oppenheim et al., 2010).

CSI effects can reveal how naming experiences influence processing (Oppenheim et al., 2010) and, arguably, representational strength. The study of CSI in children can provide important insights into the effects of experience on less robust systems, and developmental continuity and change within the lexical system. To date, however, research on CSI in children has been limited. Charest (2017) demonstrated that 3-year-olds experience cumulative semantic interference among contiguous responses, with greater slowing for 28 animals named in sequence compared to a mixed condition. This study offered a promising indication of CSI in young children, but was not designed to speak to interference between non-contiguous responses, or effects across development.

In this poster, I will report two studies of CSI in 8-year-old children. In Study 1, children named 28 animals in a continuous list, and a mixed control list (identical to Charest, 2017). Results revealed slowing across trials, but no difference between semantically homogenous and mixed sets. In Study 2, children named 12 sets of 6 semantically-related items separated by 2, 4, 6, or 8 unrelated items. Results revealed that prior related responses, but not trial number, predicted response time. There was a significant slowing of responses with position within the semantic set.

The results of Study 2 reveal CSI effects in 8-year-old children. Variation in results between Studies 1 and 2 may potentially be traced to strategic differences invited by the methods. Future directions will be discussed, as well as methodological considerations for working across ages in early development.

Lexical and post-lexical factors in dysfluency anticipation in adults who stutter

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Adults who stutter (AWS) most commonly report that they can anticipate upcoming stutter events: even before a planned utterance is fully encoded and overtly articulated, a speaker who persistently stutters often has the sensation that a certain part of speech will be produced dysfluently. To date, it is not clear whether (i) these anticipatory sensations are in fact specific to speakers who stutter and (ii) what these anticipations are based on.

In the current study, we tested the quantity and accuracy of anticipations in a group of 21 AWS and 21 matched controls consisting of adults who do not stutter (ANS).

To this end, we collected anticipation judgments after a silent reading trial of six short narratives that were subsequently read aloud. Any kind of dysfluencies were transcribed using video-recordings of the overt reading sessions. Anticipation judgments were evaluated against the actually occurring stutter events.

We examined a set of linguistic factors that have previously been found to be implicated in stuttering to test whether speakers' anticipations of stutter occurrences exploit these linguistic factors as well. Analyses were conducted using log-linear mixed effects models, taking participants and words as random factors. Overall, AWS reported significantly more anticipations than ANS. Moreover, across AWS, lexical factors (i.e., Word Frequency, Sentence Position) play a role in Stuttering and Anticipation models. Post-lexical factors (i.e., Onset Complexity) and specific combinations of lexical/post-lexical factors were found to be involved in AWS' individual internal models of Stuttering and Anticipation.

The findings are discussed against the background of cognitive models of spoken production and self-monitoring- and control models. The implications for treatment programs are also discussed.

Bilinguals' referential choice in common and privileged ground

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Appropriate references are a prerequisite for successful communication, but monolinguals and bilinguals differ in their choice of referential expressions. Bilinguals may over-use pronominal forms in a null-subject second language (L2) such as English. Such residual indeterminacy could be due to an increased need for cognitive resources when computing structures between syntax and pragmatics such as referential expressions (the Interface Hypothesis, IH). The present research tests if the IH can explain bilingual referential choice by examining the production of pronouns and noun phrases (NPs) in non-balanced Spanish-English bilinguals in common and privileged ground (i.e., when the preceding discourse is shared by speaker and listener or only known to the speaker). The privileged ground condition is potentially more cognitively effortful, because the speaker has to consider the addressee's discourse model and choose a more explicit referring expression (i.e., a NP). According to the IH, in privileged ground bilinguals in their L2 may be more likely to differ from monolinguals by producing fewer NPs, relative to common ground.

Twenty-one English monolinguals and 44 Spanish-English bilinguals participated in a story-telling task in English (L2). Participants heard a two-sentence description of a picture, and then produced descriptions of a second picture to a confederate. The second context sentence was either presented to both participant and confederate (common ground) or only to the participant (privileged ground).

Participants produced more NPs in the privileged ground than in the common ground condition ($p < 0.02$), and monolinguals produced more NPs than bilinguals ($p < 0.03$). However, the difference between bilinguals and monolinguals was similar in the common and privileged-ground conditions, inconsistent with the IH. In a currently on-going experiment, we test the IH in a picture-description task under verbal and non-verbal cognitive load.

The role of syntax and semantics on production planning

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We conducted two eye-tracking experiments to investigate whether the process of translating abstract thought to language – linguistic encoding – is primarily driven by syntactic or semantic structure. Prior work (Griffin & Bock, 2000) suggests syntax plays a privileged role, but other factors may have complicated those results. We use Agent-Patient/AP (*'confronts'*), Experiencer-Stimulus/ES (*'fears'*), and Stimulus-Experiencer/SE (*'frightens'*) verbs to provide novel evidence that linguistic encoding is not driven by syntactic or semantic prominence alone, but by the mapping of syntactic to semantic prominence. Crucially, the most semantically prominent argument (Experiencer; Grimshaw, 1980) in SE verbs is not the most syntactically prominent argument (subject) of the sentence. Thus, SE verbs can be used to delineate the role of syntax versus semantics in determining the starting point of linguistic encoding.

In Exp1, results from speech latencies and eye-movements from a see-and-describe task show: (1) Pre-linguistic *message formulation* (200-400ms after image onset) is guided by the semantic structure of the utterance: Speakers preferentially fixate the more semantically prominent argument first, regardless of grammatical role. (2) *Linguistic encoding* (after 400ms) is guided by the mapping between syntactic and semantic prominence, not by one type of structure over the other. Crucially, when syntactic and semantic prominence do not converge – as in the case of SE verbs – speakers show slower speech onset times and prolonged competition in eye-movements. AP and ES verbs – where syntactic and semantic prominence align – show no such patterns, indicating that experiencer and stimulus arguments are not categorically harder to encode than agents and patients. In Exp2, we investigated whether effects in Exp1 stemmed from non-linguistic factors (visual salience, image interpretability) rather than sentence planning processes. We conducted a non-linguistic picture inspection task which – corroborated by post-experiment questionnaires and speech errors data – indicates that Exp1's results are due to language planning processes, not extra-linguistic artefacts.

Priming L2 distractors when naming pictures in L1:

A picture-word study with Swedish-English bilinguals

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Studies on spoken word production in bilinguals have investigated language specificity by using the picture-word task where participants name objects while ignoring superimposed distractor words. Dylman and Barry (2018) found that for naming objects in L2, naming latencies were faster when the distractor was the translation equivalent in participants' L1 (e.g., DOG+perro for English-Spanish bilinguals), but there was little to no effect from the same type of translation distractors in L1 when naming in L2 (e.g., PERRO+dog). These results were interpreted in terms of facilitatory connections between the lexical representations of translations with stronger L2-to-L1 than L1-to-L2 connections.

The current study followed up on these findings by further activating the lexical representations of L2 translations when naming in L1. Swedish-English bilinguals (N = 25) living in Sweden named objects using their L1 (Swedish), with distractor words that were either the L2 translation of the target object, or an unrelated control word in L2. Crucially, a subset of the distractors were primed prior to the naming phase. If there are no direct facilitatory connections between translation equivalent lexical representations, priming the L2 translations of the target pictures should slow down or not affect (but not speed up) naming latencies. In contrast, we found that when the L2 translation distractors were primed, object naming times in L1 were reliably *faster*. This finding may have significant implications for current models of speech production and the role of competition in lexical selection in bilinguals.

Serial or parallel dual-task language processing:

Production planning and comprehension are not carried out in parallel

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During conversation, people engage in linguistic dual-tasking when comprehending and planning speech. Little research has investigated how two linguistic tasks are carried out simultaneously, which underlies the ability to plan and comprehend speech in parallel. In three experiments we tested the seriality of lexical selection and a linguistic (syllable identification/choice) or non-linguistic (tone identification/choice) comprehension task, by measuring semantic interference in naming latencies (using categorically-related versus unrelated written distractors across images). Experiment 1 used a typical dual-tasking paradigm where participants pressed a button to identify the syllable/tone, and named the pictures. Two SOAs between auditory and visual stimuli onsets were used: 0ms and 1000ms. We found interference at both SOAs in both linguistic/non-linguistic conditions, indicating serial processes of syllable/tone identification and lexical selection. Experiments 2 and 3 used a task choice paradigm, where the syllable/tone determined whether the picture should be named or the distractor word read aloud. Again, two SOAs of 0ms and 1000ms were used. Previous research with this paradigm suggests parallel processing of lexical selection and a non-linguistic choice task (Piai, Roelofs & Schriefers, 2015). In both task choice experiments we measured interference at both SOAs in the linguistic condition, suggesting serial processing of syllable choice and lexical selection. For the non-linguistic task, in Experiment 2 we measured no interference at either SOA, and in Experiment 3 we measured interference at both SOAs. These results are inconclusive with regards to serial or parallel processes of task choice and lexical selection. Additionally, in all experiments, we found that naming latencies were slower in the linguistic than in the non-linguistic condition at SOA 0ms, but not at SOA 1000ms. This demonstrates that dual-tasking with two linguistic tasks results in general interference. Our results most strongly suggest that when dual-tasking with two linguistic tasks, a serial processing strategy is preferred.

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Language production across the lifespan:

Insights from inferential naming

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Language production abilities display specific dynamics across the lifespan. The vocabulary grows continuously (Salthouse, 2004) but lexical retrieval and word production latencies measured with referential tasks are slower in children and elderly relative to young adults.

Previous work using referential tasks suggest age-related changes of pre-lexical processes rather than word-form encoding. Here we use inferential naming, which is assumed to require deeper lexical-semantic processes (Fargier & Laganaro, 2017) to further advance this issue.

Notably, we asked whether production latencies in inferential naming tasks follow the same dynamics as in referential naming and use electroencephalography (EEG) to inform on the locus or loci of age-related changes in inferential speech planning processes.

We recorded high-density EEG while participants overtly produced words in response to short oral definitions. Four groups of participants took part in the study including children (10-12 years), adolescents (16-18 years), young adults (20-30 years) and older adults (60-80 years). Analyses of waveforms and microstates were used to explore neural dynamics of inferential naming.

Behavioral results revealed a significant main effect of age groups with slower production latencies in children (M=1060 ms) relative to all other groups (adolescents (M=921 ms; $p=0.031$), young adults (M=860 ms; $p=0.003$) and elderly (M=863 ms; $p=0.003$). EEG analyses revealed both qualitative (different topographic configurations) and quantitative (temporal shifts) age-related changes, in particular in time-windows previously ascribed to lexical selection in inferential naming (<300 ms; Fargier & Laganaro, 2017).

Our results therefore suggest age-related changes in pre-lexical speech planning processes also in an inferential task. Future work integrating both referential and inferential naming will likely offer interesting perspectives on how cognitive and language processes change across the lifespan.

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A close call: Interference from semantic neighbourhood density and semantic neighbourhood distance

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This study investigated how lexical selection is influenced by the number of semantically related representations (semantic neighbourhood density) and their similarity (semantic distance) to the target in a speeded picture naming task. Semantic neighbourhood density and distance as continuous variables were used to assess the nature of lexical selection for which competitive and non-competitive mechanisms have been proposed. If lexical selection is competitive, we predicted to find interference due to stronger lexical competition with an increasing number and semantic similarity of a target's semantic neighbours. If lexical selection is non-competitive, no effects of semantic neighbourhood density and distance on naming should be found. Previous studies found mixed effects of semantic neighbourhood variables, leaving this issue unresolved. Here, we demonstrate interference of semantic neighbourhood distance with less accurate naming responses and an increase of semantic errors and omissions for words with semantically closer (more similar) neighbours. No main effect of semantic neighbourhood density and no interaction between density and distance was found. We assessed further whether semantic neighbourhood density can affect naming if semantic neighbours exceed a certain degree of semantic similarity. Semantic similarity between the target and each neighbour was used to split semantic neighbourhood density into two different density variables: The number of semantically close neighbours and the number of semantically distant neighbours. The results showed a significant effect of close, but not of distant semantic neighbourhood density. Naming pictures of targets with more close semantic neighbours led to longer naming latencies, less accurate responses, and an increased production of semantic errors and omissions. The results showed that word inherent semantic attributes such as the distance of semantic neighbours and the number of co-activated close semantic neighbours modulate lexical selection. These results support theories competitive lexical selection.

Breaking the dark side: A computational neuropsychological approach

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Computational models of speech production must explain both findings from unimpaired speakers and patterns of impairment observed following brain damage. The current project simulates brain damage in a scaled version of the Dark Side model of lexical access (Oppenheim, Dell & Schwartz, 2010). The Dark Side model implements several core connectionist assumptions— competitive selection, shared activation and incremental, error-driven learning— into a computational model of lexical access. The model was reliably able to qualitatively predict the patterns of performance observed in unimpaired speakers. However, the original model included only a small vocabulary and an unrealistic representation of semantics, so questions remained about its ability to scale. A scaled version of the model has recently been developed with a larger vocabulary and a more realistic representation of semantics (Oppenheim, 2016). The scaled model is capable of both qualitatively and quantitatively matching the patterns of performance on specific lexical access experiments.

The present study compares the predictions of the scaled Dark Side model to the patterns of naming impairments observed in aphasia. Specifically, three thousand models were individually trained with the same vocabulary of approximately 1500 words. Each model was damaged by adding varying levels of Gaussian noise and given a single administration of the Philadelphia Naming Test (PNT). Patterns of errors produced by the damaged models were then compared to the performance of aphasic patients drawn from the Moss Aphasia Project Database.

Simulations of the Dark Side model demonstrate that the theory can account for qualitative trends observed in the aphasic patient data. The model, in its default state, however cannot explain the quantitative results of both the error build up as well as the nature of the perseverations. Further work will explore how the model can be modified to match patient data both qualitatively and quantitatively.

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It's time to prime time!

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Syntactic priming has greatly contributed to our understanding of the language production process. Findings show that syntactic encoding, at least in part, can be independent from the specifications in the preverbal message. However, to date only a relatively small number of different syntactic structures has been used to study priming. Here, we (re-)introduce a new structure to broaden our understanding of the underlying representations involved in structure repetition: the Dutch progressive (*aan het*-construction; *Wij zijn een abstract aan het schrijven* 'We are writing an abstract'). Gerwien & Flecken (2015) showed that Dutch native speakers, but not advanced German learners of Dutch, can be primed to use the *aan het*-construction in the classic running recognition paradigm (Bock, 1986). They argued that the effect is partially due to priming at the conceptual level, showing that aspectual viewpoint selection can be primed.

Here, we set out to replicate these findings and to test the factors underlying this effect further. We tested a large sample (N=90 Dutch natives) and included four priming conditions: 1) neutral prime (*Peter typt een smsje*); 2) transitive progressive prime (*Peter is een smsje aan het typen*); 3) intransitive progressive prime (*Peter is aan het bellen*); 4) form prime (*Peter werkt aan het artikel*). All target pictures showed an affected object, favoring transitive event descriptions.

We find a reliable priming effect for the transitive progressive prime condition only. The absence of an effect in the form prime condition shows that superficial form features (the PP *aan het*) alone are not sufficient to elicit structure repetition. More importantly, the absence of a priming effect in the intransitive progressive condition suggests that viewpoint aspect and event participant information form a bundle of features, represented together tightly. Thus, viewpoint aspect, as a conceptual feature, cannot be primed in isolation.

From theory to substrate:

Using psycholinguistic features to decode function from cortical dynamics

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People can generate the name for an object and articulate that word with remarkable speed, precision, and fluency. This process of speech production involves an integrated multistage process that seamlessly translates conceptual representations in the brain to acoustic output – a defining human faculty that allows for eloquent communication. Study of the neural mechanisms driving a speech production network characterized by rapid, transient dynamics requires a methodology with high spatiotemporal resolution.

Intracranial electrodes (n = 18350, 109 patients), including both surface grid electrodes and penetrating stereotactic depth electrodes, were implanted as part of an electrocorticographic evaluation for epilepsy. These furnish the full spectrum of neural oscillations at millimeter spatial and millisecond temporal resolution in the human brain, providing an ideal methodology by which to study fundamental language processes. Patients performed a simple picture naming task. To delineate nodes of the bilateral articulatory network, we implemented a surface-based mixed-effects multilevel analysis of broadband gamma activity (BGA). Subsequently, we derived the psycholinguistic correlates of these network nodes with a multivariate linear regression on BGA across variables representing visual, semantic, lexical, and phonological processing.

With complete coverage of the language-dominant hemisphere, we are able to generate a millisecond resolution movie of the group average cortical dynamics from picture presentation through overt articulation. This analysis revealed 9 regions of interest, presented in order of activation: early visual cortex, fusiform gyrus, intraparietal sulcus, supplementary motor area, anterior insula, inferior frontal gyrus, ventral sensorimotor cortex, early auditory cortex, and lateral superior temporal gyrus. These regions showed variability sensitivity to stimulus visual complexity, semantic feature density, lexical neighborhood density, phonologic complexity, and articulatory duration.

This work integrates large-scale human electrocorticography with psycholinguistic models of speech production to elucidate the neural basis of cognitive processes thought to lead from intention to articulation.

Interference prevails? A quantitative research synthesis of the picture-word-interference paradigm

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We conducted a meta-analysis investigating the influence of facets of the picture-word interference paradigm. Variability of effect sizes between studies, within studies, and due to sampling error, was modelled by multilevel meta-analysis. True within-study parameter variation (32.71%) was larger than true between-study parameter variation (22.14%). Overall, a meta-analytic summary of 551 effect sizes (Hedge's g based on change scores) obtained from 66 articles indicated a small semantic interference effect averaged over categorically as well as for associatively related picture-word pairs ($g = 0.11$, 95%-CI: [0.06, 0.16]). Categorically related pairs revealed a positive effect of $g = 0.16$, 95%-CI: [0.11, 0.21], while associatively related pairs showed the opposite pattern with $g = -0.08$, 95%-CI: [-0.15, -0.00]. In addition, semantic interference was considerably lower when distractor words were not included in the response-set ($g = 0.08$, 95%-CI: [0.03, 0.13]) compared to experiments in which distractors were included ($g = 0.25$, 95%-CI: [0.15, 0.34]). The relation of effect sizes and SOA was quadratic rather than linear ($\chi^2(1)=5.63$, $p = .018$). Thus, at negative SOAs, negative effect sizes are more likely to occur than at positive SOAs. SOAs around zero yielded positive effects which were comparable to the overall effect. To further investigate combinations of the above-mentioned factors, SOAs were categorized in SOAs below zero, SOAs of zero, and SOAs above zero. The interference effect of categorically related distractors was fairly robust across SOAs and response-set, with the exception of negative SOA and distractors that were not included as targets. Significant facilitation was observed for associatively related distractors when SOA was negative and distractors were not included as targets. Summarizing across SOAs, response-set, and relationship, interference is the pervasive effect in picture-word interference. Associatively related distractors result in facilitation only at negative SOAs when distractors were not in the response-set.

Opposing and following responses in sensorimotor speech control: Why responses go both ways

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When talking, speakers continuously monitor the auditory feedback of their own voice to control and inform speech production processes. When speakers are provided with auditory feedback that is perturbed in real time, most of them compensate for this by opposing the feedback perturbation. For example, when speakers hear themselves at a higher pitch than intended, they would compensate by lowering their pitch. However, sometimes speakers follow the perturbation instead (i.e., raising their pitch in response to higher-than-expected pitch). Current theoretical frameworks cannot account for following responses. In the current study, we performed two experiments to investigate whether the state of the speech production system at perturbation onset may determine what type of response (opposing or following) is given. Participants vocalized while the pitch in their auditory feedback was briefly (500 ms) perturbed in half of the vocalizations. None of the participants were aware of these manipulations. Subsequently, we analyzed the pitch contour of the participants' vocalizations. The results suggest that whether a perturbation-related response is opposing or following unexpected feedback depends on ongoing fluctuations of the production system: It initially responds by doing the opposite of what it was doing. In addition, the results show that all speakers show both following and opposing responses, although the distribution of response types varies across individuals. Both the interaction with ongoing fluctuations and the non-trivial number of following responses suggest that current speech production models are inadequate. More generally, the current study indicates that looking beyond the average response can lead to a more complete view on the nature of feedback processing in motor control. Future work should explore whether the direction of feedback-based control in domains outside of speech production will also be conditional on the state of the motor system at the time of the perturbation.

The perception-production interface: Insights from cumulative semantic effects

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Picture naming time increases linearly as a function of the number of previously named pictures from a semantic category (e.g., fork, spoon, cup, etc.), whereas picture categorization time (living vs. non-living) decreases linearly. These cumulative semantic effects have not yet been studied in speech comprehension. In this study, we investigated cumulative semantic effects in spoken word production and comprehension using tasks that do or do not involve retrieval of syntactic properties, such as gender, associated with the word. Our aim was to test for cumulative semantic effects across production and comprehension and hence address the nature of their relation. We used four tasks (two production and two comprehension tasks) in a within-subject (N=32) experimental paradigm. One task from each modality involved retrieval of the determiner associated with the word while the other did not. The tasks were: bare picture naming, determiner-marked picture naming, and two button-press tasks, semantic judgement and determiner judgement on auditorily presented words. The stimuli set for each task had nine semantic categories with four items each. We analyzed the data obtained using linear mixed models to investigate the effect of ordinal position within a category on naming and button press latencies. Our analyses showed replication of the cumulative semantic interference effect on the bare picture naming task (slowing down by 30 ms from ordinal position one to four). A cumulative semantic facilitation effect was found in the semantic judgement task (speeding up by 40 ms from ordinal position one to four). Trends towards cumulative semantic interference and facilitation were found in the determiner-marked picture-naming task and determiner-judgement task respectively. These findings indicate that cumulative semantic effects occur in both production and comprehension, challenging feedforward-only production models of the effects.

Interference and facilitation in spoken word production due to diagnostic colour features

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Decompositional and non-decompositional models of lexical selection make different predictions regarding the effect a single feature can have in the presence of a superordinate category.

In two picture-word interference experiments we tested the effect of a single perceptual/conceptual feature, diagnostic object colour, in the presence or absence of a superordinate category relationship (living/ non-living). Pictures of items were paired with a distractor that was congruent (LEMON- lemon), colour related superordinate (LEMON- chick), colour related non-superordinate (LEMON-bulldozer), unrelated superordinate (LEMON-horse), unrelated non-superordinate (LEMON- brick). The experiment was performed with coloured pictures, and with black and white line drawings.

Compared to a colour unrelated distractor, when target and distractor share a superordinate category relationship (e.g., living things), naming latencies increase (interference) when target and distractor also share a diagnostic colour feature. However, when target and distractor are not related at the superordinate level, latencies decrease (facilitation) with a shared diagnostic colour feature. This pattern occurred at each of the three SOA's (-150, 0, 150). Interestingly, this pattern was identical for black/white line drawing pictures and coloured pictures.

The findings are consistent with the predictions of a decompositional account of lexical selection. That the effect was also observed with black/white pictures suggest that the colour diagnostic feature is a fundamental aspect of object knowledge

Children's adjustments to listener needs in spontaneous event descriptions

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Adults design utterances to match listeners' informational needs by making both 'generic' adjustments (mentioning atypical/unpredictable more often than typical information) and 'particular' adjustments tailored to their specific addressee (e.g., including things that their addressee cannot see; Brown & Dell, 1987; Lockridge & Brennan, 2002). Developmental research has focused on children's 'specific' adjustments and has produced mixed findings (e.g., Deutsch & Pechmann, 1982; Nadig & Sedivy, 2002). Three experiments investigated how generic (typicality of instruments) and particular factors (listener's visual access, conversational profile) affect children's production.

In Experiment 1, 5-year-olds and adults described events to a silent confederate-listener who either saw or could not see the events. In each event, an agent performed an action using a typical or an atypical instrument (e.g., watering plants with watering can/hat). Experiments 2-3 modified Exp.1 by having participants describe the same events to a silent (Exp.2) or interactive addressee (Exp.3) with a specific goal (i.e., draw the events described). Results showed that, across all experiments, 5-year-olds and adults were more likely to mention atypical than typical instruments ($ps < .001$) and adults mentioned instruments, overall, more frequently than children ($ps < .001$). Furthermore, adults were more likely to mention instruments when the events were not visible to their (silent) interlocutor ($ps < .01$; Exps.1-2) but in children visual access did not affect instrument mention in any experiment ($ps > .05$). A comparison across experiments showed that mention of instruments increased when participants communicated with an interactive interlocutor ($p < .01$).

In sum, adults performed both generic and particular adjustments to addressees' needs. Five-year-olds also made generic adjustments but their ability to make listener-particular adjustments was inconsistent. These findings point to a nuanced model of children's audience design, where adjustments to listener's needs that require frequent updating (i.e., visual access) are harder to implement than less dynamic adjustments (i.e., listener's communicative profile, predictability/typicality of instruments).

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**ERP evidence for the relationship between executive function and language control
in bilingual word production**

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Some studies have shown that bilinguals performed better than their monolingual counterparts in tasks tapping into general executive functions (e.g., Martin-Rhee & Bialystok, 2008). Evidence has also shown that general inhibition or shifting function could predict language control processes.

The present study investigated the relationship between the executive function on the language control mechanism during bilingual word production. We used a flanker task, a task-switching task and an n-back task to tap into the inhibiting function, the shifting function and the updating function respectively. In addition, a cued language switching task was adopted to investigate the language control processes during bilingual word production. Fifty-five Chinese-English bilinguals participated in the present study. Participants were required to first complete a cued language switching task, during which both their behavioral data and EEG data were collected. Then, they were required to take the flanker task, the task-switching task and the n-back task.

We found that, compared to non-switch trials, picture naming in switch trials elicited a larger stimulus-locked N2. Moreover, only the flanker effect significantly predicted the variability of the stimulus-locked N2 switch effect. Specifically, stronger interference suppression ability, as reflected by a smaller flanker effect, facilitates inhibition on lexical items in the non-target language, as indicated by a larger N2 switch effect in the stimulus-locked ERPs. These results indicate that inhibition is exerted during bilingual word production. Furthermore, domain-general inhibiting function predicts the real-time intensity of bilingual language control.

**Phonological neighbourhood density and frequency in English picture naming:
Australian and British behavioural data and computational modelling.**

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The presence/direction of phonological neighbourhood density (PND) and frequency (PNF) effects on speech production are still debated (e.g., Sadat et al., 2014). In visual word recognition (e.g., Grainger et al., 1989) it is suggested that influential neighbours may be those of higher frequency than the target. This research is the first to investigate the interaction between the frequency of the target word and both PND and PNF, in English spoken picture naming in both behavioural and computational data.

Behavioural data: Forty Australian English speakers named 359 pictures. The effects of six PND and PNF measures and their interaction with target frequency were analysed using (generalized) linear mixed effects models adding the usual predictors of picture naming as control variables.

There was a significant interaction between target frequency and the summed frequency of neighbours of higher frequency than the target ($X^2(1)=5.42$, $p=.02$): the influence of PNF was inhibitory for naming latency for low frequency targets, but facilitatory for higher frequency targets. These effects on latency were replicated in an analysis of published British English picture naming data (25 subjects, 449 items: Johnston et al., 2010).

Computational modelling: DRC-SEM is an implementation of the DRC computational model of reading (Coltheart et al., 2001) that allows simulation of picture naming for monosyllabic words. Simulations used 171 monosyllabic items from the behavioural experiment and systematically modified activation parameters. There were no effects of PND/PNF measures on number of cycles for naming with DRC-SEM's default parameters (Linear regression: all $p>.18$). Increased feedback from the phoneme level to the phonological lexicon led to inhibitory effects of the critical measures, while decreased activation from semantics to the phonological lexicon led to the critical interaction observed in the human data.

These results inform the activation dynamics necessary for theories of word production to adequately account for human behaviour.

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**Ageing and sentence production:
Impaired lexical access in the context of intact syntactic planning**

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Fluent sentence production requires rapid on-line generation of syntax and retrieval of lexical items. We investigated how these processes are affected by healthy ageing. Young ($N=50$, $M=19.8$ yrs) and older ($N=56$, $M=71.8$ yrs) adults first completed a timed picture description task (Smith & Wheeldon, 2001), producing a syntactically related or unrelated prime prior to a target sentence (e.g., “the bell and the glove move up”). Both age groups displayed significant speed benefits of prior access to syntax, yielding similar priming effects. Participants then completed a planning scope task (Wheeldon et al., 2013) producing sentences with initial simple or coordinate noun phrases (e.g., “the owl moves above the car and the harp”/ “the owl and the car move above the harp”). On half the trials, the second picture (e.g., car) was previewed; critically, the previewed picture name only fell within the initial phrase in the coordinate condition. Without preview, both groups took significantly longer to initiate sentences with the larger initial coordinate phrase, suggesting similar phrasal planning scope. However, age differences did emerge in the preview conditions. While young adults displayed significant speed benefits of preview both within and outside the initial phrase, older adults only benefited from the preview within the initial phrase. Moreover, previewing a lexical item outside of the initial phrase caused older adults to become significantly more error-prone. Thus, while syntactic planning appears unaffected by age, older adults do encounter problems with managing the activation and assignment of lexical items to syntactic frameworks.

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Individual differences in effects of phonological neighborhood density in aphasia

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Individuals with aphasia have been found to name items with more phonological neighbors more accurately than those with fewer phonological neighbors (Laganaro et al., 2013; Kittredge et al., 2008; Gordon, 2002; Best, 1995). Given the enormous differences in symptoms of aphasia, we hypothesized that there would be individual differences in the effects of phonological neighborhood density (PND) on language production, possibly aligning with different clinical types of aphasia.

We explored individual differences in effects of PND in 296 individuals with aphasia from the picture naming data in the Moss Aphasia Psycholinguistics Data Project (MAPPD; Mirman et al., 2010). We ran generalized linear mixed model regressions of the effect of PND on producing each of the error types specified in MAPPD: formal, semantic, mixed, unrelated, and nonword errors. In order to control for the effect of word length, we restricted our analysis to monosyllables ($n = 29,428$). We included age of acquisition and word frequency as control variables. Individual effects of PND were captured in each model using by-subject random intercepts and slopes of PND. Model comparison was employed to assess if the random slopes of PND were justified.

We found that higher PND reduced the chance of producing unrelated, mixed and nonword errors, consistent with Laganaro et al. (2013). We did not observe an effect of PND on semantic or formal errors. A random slope of PND, capturing individual differences in the PND effect, was supported for the nonword error model only. This suggests that the effect of phonological neighbors is not identical for all individuals with aphasia. Further investigation suggests that this individual variation cannot be accounted for by aphasia type, age, or naming accuracy. We discuss these results in light of models of lexical access and retrieval in picture naming (Schwartz et al., 2006).

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Individual differences in word production:

Evidence from students with diverse educational backgrounds

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Psycholinguistic evidence suggests that lexical access in word production is predicted by the size of the speaker's lexicon. Specifically, studies have shown that individuals with larger vocabularies are faster and more accurate at producing words than individuals with smaller vocabularies. It has been argued that this advantage results from more entrenched lexical representations. In the present study, we investigated the relationship between receptive vocabulary size and various production-based abilities: maximal speech rate, production fluency, and rapid automatized naming. We subsequently tested how strongly vocabulary size and production-based abilities contribute to explaining variance in a standard word production task (picture naming), and how much variance is explained by item variables, such as word frequency. Students (N = 103) with diverse educational backgrounds participated in the study and were recruited from universities and vocational colleges. Vocabulary size correlated significantly with production fluency ($r = .33$). Picture naming accuracy was predicted by participants' receptive vocabulary and rapid automatized naming scores: Individuals with larger vocabularies and faster automatized word retrieval named pictures more accurately than individuals with lower scores on the respective tests. Moreover, we observed a word frequency-by-vocabulary size interaction, with individuals with larger vocabularies naming more low frequency items correctly than individuals with smaller vocabularies. Picture naming onset latencies were predicted by vocabulary size and rapid automatized naming scores, with higher scores resulting in faster naming. Replicating previous research, we observed that vocabulary size predicted accuracy and speed during word production. Additional variance was explained by rapid automatized naming. Taken together, our data provide support for the notion that entrenched lexical representations result in faster and more accurate lexical access. One possible mechanism for the emergence individual differences in lexical representations is differential exposure to written text. Our data strengthen such a working hypothesis as receptive vocabulary and rapid automatized naming both have strong links to literacy and reading abilities.

A little production practice provides a big boost in language learning

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Language production practice provides a stronger grammar and vocabulary learning experience than language comprehension practice (Hopman & MacDonald, 2018). Unlike in typical classroom environments, learners in that study received either only comprehension exercises or only production exercises. Here we investigate the learning benefits of language production in a more realistic setting in which learners get mostly comprehension practice and only a little production practice.

As in Hopman & MacDonald's study, English speaking participants learned a 20-word artificial language that described a cartoon world in 7-word sentences. Four word types ended in suffixes agreeing in number and gender. Participants learned this language through interleaved passive exposure and active learning blocks. In active comprehension trials, learners made a match-mismatch judgment on an auditory phrase and an accompanying picture. In active production trials, learners were asked to describe pictures aloud in the novel language. We trained 104 participants in a new Mixed-Experience condition and compared their rates of learning and comprehension to that of participants from Comprehension-Only and Production-Only training conditions (208 participants total). The Mixed-Experience condition was identical to the original Comprehension-Only condition, except that 1 trial in each active comprehension block was replaced with a production trial, affecting approximately 17% of learning trials.

After learning, participants completed speech-picture matching tests to assess understanding of grammatical agreement markers and a grammatical judgment test to assess understanding of agreement rules. Although the Mixed-Experience condition differed from the Comprehension-Only condition in only about 1/6th of the learning trials, the Mixed-Experience participants significantly outperformed Comprehension-Only participants on tests of comprehension. These results show that even a small amount of production practice provides strong learning and comprehension benefits compared to a comprehension-only curriculum. We will discuss potential mechanisms for this effect and implications for language learning.

The effect of lexical neighborhood on semantic satiation

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Semantic saturation, or semantic satiation, is the phenomenon wherein a word repeated many times by a speaker begins to lose meaning. Previous work on semantic saturation and the related Verbal Transformation Effect has found that it causes brain activity in regions related to lexical memory (Anahita Basirat et al., "Parieto-frontal gamma band activity during the perceptual emergence of speech forms", *Neuroimage* 42(1) 2008). This suggests that semantic saturation occurs at the level of recall instead of perception. The present study aims to relate the effect of semantic saturation to lexical neighborhood of the word in question, a metric that measures both the number of other phonetically similar lexical items and the relative frequency of those items. It is hypothesized that lexical items with a large lexical neighborhood will undergo semantic saturation faster. This is because a lexical item's lexical neighborhood is considered during the recall phase of semantic extraction instead of the perception phase (Newman, Sawusch, & Luce, "Lexical Neighborhood Effects in Phonetic Processing", *Journal of Experimental Psychology*, 23(3) 1997). Semantic saturation is measured using the method pioneered by Lambert and Jakobovits ("Verbal satiation and changes in the intensity of meaning", *Journal of Experimental Psychology* 60(6) 1960). Preliminary results support this hypothesis, with repetition of the word "book" resulting in semantic saturation faster than the word "computer". This supports both the current understanding of semantic saturation as well as providing a deeper understanding of the phonetic processing of lexical items.

Phonetic correlates of sublexical contributions to reading aloud familiar words

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The ability to read words aloud requires the coordination of the cognitive system responsible for visual word recognition and that responsible for speech production. In dual-route connectionist (DRC) models of reading (Coltheart et al., 2001), there is cascading activation from the initial orthographic analysis of the letter identities in the word extending through the lexical and sublexical processes to level of representation that has been argued to correspond to the post-lexical phonological level in theories of spoken production (Goldrick & Rapp, 2007). Certain types of written words, specifically irregular inconsistent words, have conflicting phonological plans generated by the lexical and sublexical routes. For example, lexical processing of the word BREAD yields the phonological plan /brɛd/, while sublexical processing yields the phonological plan /brid/. The current study uses phonetic measurement during reading aloud to investigate these assumptions of the DRC model.

Previous studies of speech production have used phonetic measurement as a tool to evaluate how information cascades from the level of post-lexical phonological planning to articulatory implementation by demonstrating that there are phonetic *traces* of the phonemes activated, but not selected (Goldrick & Blumstein, 2006). Using this logic, we investigated whether there are phonetic traces of the phonological plan generated by the sublexical route, even when participants correctly read words aloud using the pronunciation generated by the lexical route. Analysis of formant frequencies reveal that despite the presence of competing lexical and sublexical phonological plans, there is not a phonetic trace of the nonselected sublexical process. We interpret this null result as evidence for a theory of reading that is not fully cascaded. Rather, a selection event takes place prior to articulatory implementation, and a single phonological plan is carried out in articulation.

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Bilingual - and monolingual? - Language control mechanisms

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Bilinguals possess efficient control mechanisms to avoid unwanted wrong-language intrusions, but how specific are these mechanisms to bilinguals? Even within a single language, speakers need to control which words they say when, to avoid unwanted semantically-related or wrong-register intrusions.

Two groups of Spanish-English bilinguals (non-balanced and relatively balanced) switched between naming 12 pictures in each of their two languages (e.g., dog; dominant name) or perro [non-dominant name; Sp. dog]). English monolinguals switched between naming 12 pictures with a basic-level (dog; dominant name), and a subordinate name (Dalmatian; non-dominant name). Sessions began with two single-naming blocks in counterbalanced order, followed by three mixed blocks, followed by two further single-naming blocks.

Mixing costs (stay trials in mixed blocks slower than single blocks) were larger for non-dominant than dominant names for non-balanced bilinguals and monolinguals, and equivalent for the two name types for balanced bilinguals. Switching costs (switch trials slower than stay trials in mixed blocks) were similar for dominant and non-dominant names for all three groups. Of note, the speed difference between dominant and non-dominant responses decreased between the first and last single-naming blocks to a similar extent for all three groups. Also, non-dominant responses benefitted from practice more than dominant responses, similarly for all three groups. A between-group difference was that monolinguals showed reverse dominance: After the first single-naming blocks, subordinate names were produced more quickly than basic-level names, likely due to some of our pictures more readily eliciting subordinate names.

In sum, monolinguals showed equivalent (asymmetrical) mixing costs to non-balanced bilinguals, and equivalent (symmetrical) switching costs, equivalent dominance-effect reduction and equivalent practice benefits to both bilingual groups. These results suggest that, when monolinguals have to select between a dominant and a non-dominant name, they employ similar control mechanisms to bilinguals selecting between names in each of their languages.

Spoken language production in Primary Progressive Aphasia: Differentiation of variants

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Primary progressive aphasia (PPA) is an acquired language deficit, with aphasia being the most prominent aspect of the clinical picture, that is due to progressive neurodegenerative disease. PPA comprises three main variants, varying in clinical presentation, patterns of brain atrophy, and underlying pathology: non-fluent/agrammatic (nfv-PPA), logopenic (lv-PPA), and semantic dementia (sv-PPA). Differentiation of these subtypes is important for treatment and planning; however, the distinction between PPA variants remains challenging for clinicians, especially for the nfv-PPA and the lv-PPA variants. Spoken language production in nfv-PPA is nonfluent and agrammatic, in lv-PPA shows profound word-finding difficulties, and in sv-PPA is fluent but with semantic errors. The only available brief language battery for differentiation of the three PPA subtypes is the Sydney Language Battery (SYDBAT), which measures naming, single-word comprehension, semantic association, and repetition abilities in English. We adapted this battery for Dutch, called SYDBAT-NL, and have started validating the battery on Dutch patients. Our first results revealed distinct patterns of impairments on the SYDBAT-NL subtests across PPA variants. However, several patients were misdiagnosed, indicating the need for additional means to differentiate among patients. To this end, we examined the role of episodic and working memory in PPA by performing a meta-analysis of the literature. The results revealed that episodic memory deficits, but not working memory deficits, are more pronounced in lv-PPA than nfv-PPA. This suggests that episodic memory tests may be helpful to distinguish between these PPA variants. We aim to further substantiate and expand our findings by investigating the underlying patterns of brain atrophy in these patients in order to aid in the diagnostic process of PPA.

When does reading dirty words impede picture processing?

Taboo interference with verbal and manual responses

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Picture naming takes longer in the presence of socially inappropriate (taboo) distractor words compared to neutral distractor words. Previous studies have attributed this taboo interference effect to increased attentional capture by taboo words or verbal self-monitoring, that is, control processes checking prepared verbal responses before articulation. In this study we investigated the cause and locus of the taboo interference effect by contrasting three tasks which used the same target pictures, but systematically differed with respect to the processing stages involved: picture naming (requiring conceptual processing, lexical processing, and articulation), phoneme decision (requiring conceptual and lexical processing), and natural size decision (requiring conceptual processing only). We observed taboo interference in picture naming and phoneme decision. In size decision, taboo interference was not reliably observed under the same task conditions in which the effect arose in picture naming and phoneme decision, but emerged when the difficulty of the size decision task was increased by visually degrading the target pictures. Overall, these results suggest that taboo interference cannot be exclusively attributed to verbal self-monitoring operating over articulatory responses. Instead, taboo interference appears to arise already prior to articulatory preparation, during lexical processing and – at least with sufficiently high task difficulty – also during pre-lexical processing stages.

The relative clause asymmetry is shaped by role tracking difficulties

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Subject-/object-extracted relative clauses (SRC/ORC) have different role/referent bindings that may contribute to the asymmetry in RC processing. We used a multiple object tracking task where two separate push events occurred between identical circles, followed by periods of random motion. In the SRC-target conditions, the same object was the agent in both pushes. In the ORC-target conditions, the patient of the first push was the agent of the second. After more random motion, four of the circles were given different colors and the participants described how these objects interacted using an RC: "the red that pushed blue pushed green" (SRC) or "the red that blue pushed pushed green" (ORC). Experiment one found that description accuracy was significantly higher for the SRC-target trials (M = 74.39%) than the ORC-target trials (M = 52.58%). This was replicated in experiment two (SRC-targets = 78%; ORC-targets = 55%), where the participants were instructed to use passive ORCs (e.g. "the red that was pushed by blue pushed green"), as these can be easier in English (Gennari & MacDonald, 2008). In the third study, participants described the same stimuli with active transitive sentences (e.g., "red pushed blue") and we found significantly higher accuracy in the SRC (M = 76.83%) than ORC-target trials (M = 68.17%). Since these SRC/ORC differences were observed without animacy differences and even when non-RC structures were used, the results suggest that tracking the agent-patient information for the ORC main clause subject imposed a cost that influenced the message generation process (Levelt, 1993) and created a subject/object asymmetry in production. We suggest that these biases in production may shape the frequency/structural biases implicated in the RC asymmetry in comprehension (MacDonald, 2013).

**What does it take to produce a word:
Certain brain states or cognitive control?**

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Language production not only relies on language specific processes but also on domain-general skills (Shao et al., 2012, *Q J Exp Psychol*, 65:10). These domain-general skills have been linked to stable aspects of brain functioning. For instance, it has been shown that alpha power, the number of neurons discharging synchronously at 10Hz, measured at rest predicts intelligence (Doppelmayr et al., 2002, *Intelligence*, 30:3). The present study investigated whether word production is also predicted by resting state power or only indirectly via domain-general skills. Five minutes of eyes-closed resting state EEG was recorded from 34 Dutch young adults (data collection ongoing). Power was calculated across three frequency bands: theta (4-7.5Hz), alpha (8-12.5Hz) and low beta (13-14.5Hz), values from the electrode with the highest average power were selected (theta FCz, alpha PO3, beta PO8). Participants performed a picture naming task to measure word production. Latencies were decomposed into mu and tau, the normal part and right tail end of the RT distribution, respectively. Furthermore, measures were collected for intelligence (Raven's score), processing speed (factor from simple, choice, and letter comparison RT), attention (attention network test, factor from alerting, orienting and executive control effects), and working memory (total score forward and backward digit span). The results showed that none of the power values significantly explained variation in picture naming latencies. Working memory correlated with the mu parameter of naming latencies ($r = .35, p < .05$). Surprisingly, higher digit span scores were related to slower naming. Speed was correlated with the tau parameter of naming latencies ($r = .34, p < .05$). Individuals with slower general speed had a larger proportion of slow naming trials. All in all, these results suggest language production is, at least partly, subserved by cognitive control, but is not directly driven by stable network properties of brain functioning.

Onomatopoeia, speech or not? Validation of a database onomatopoeia's production

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Recent neuroimaging studies have demonstrated that onomatopoeia (words mimicking animal or objects sounds) are processed differently, implicating extensive brain regions involved in the processing of both verbal and nonverbal sounds (Hashimoto et al., 2006; Egashira et al., 2015). So far, studies have only assess onomatopoeia via comprehension tasks.

The aim of this pilot study was to create a database of pictures which can be associated with the production of onomatopoeia and of verbs in French in order to be used in production studies. First, 150 French speakers participated in an online study testing 132 pictures: half of the participants were asked to write the corresponding verb and the other half had to write the onomatopoeia (e.g.: "bark" vs "woof"). Results of the online study were used to determine the best stimuli based on the modal names and to design a behavioral study. Verbs and onomatopoeias were matched on the number of phonemes (verbs: 4,21; ono: 4,03) and syllables (verbs: 1,46; ono: 1,46). 30 French speaking participants completed a two-blocks picture naming task (66 pictures for the verbs block and 66 different pictures for the onomatopoeia) after a phase of familiarization where participants were shown all the pictures used in the experiment and heard all the matching audio stimuli. Behavioral results of vocal response times show that, whereas accuracy is similar in both conditions, participants are 30ms faster to produce onomatopoeia relative to verbs and that this difference is significant.

Above all, the purpose of this pilot study was to assess the feasibility of comparing verbs and onomatopoeia in a picture naming task. In order to investigate their dual nature (imitative-driven transformation of a sound of nature into a word), the stimuli will be more precisely matched (first phoneme, frequency...) and used in a dual-EEG study on the neural correlates of onomatopoeia's perception/production.

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**Short and long-term effects of foreign-language learning on bilinguals' production
in both their languages**

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Foreign (second) language (L2) learning has side effects for native language (L1) production, as L1 sounds might show a drift towards (assimilation) or away from (dissimilation) the phonetic properties of L2 sounds. The nature and the amount of L1 drift depend on a number of factors, among which the factors related to L1 use seem to exert the strongest effects. Yet, it remains to be established how L2 learning affects native production in individuals who have two native languages, i.e., in simultaneous or very early bilinguals. Does foreign language learning (here a third language, L3) affect bilinguals' both languages or only one? What is the nature of drift and its longevity? The current study examines the effects of L3 (English) learning on the production of vowels in the two native languages of simultaneous Spanish-Basque bilingual adolescents enrolled into the Erasmus study abroad (SA) English program. Ten bilingual speakers read five Spanish and Basque CVCV words two months before their SA, the next day and four months after their arrival back to Spain. Each word contained the target vowel in the stressed syllable and was repeated five times. Acoustic analyses measuring vowel openness (F1) and backness (F2) were performed. The results revealed that speakers who used both languages equally often (balanced users) showed an F1 drift in both languages toward the F1 of the English vowel space. Unbalanced speakers, on the other hand, showed a drift only in the less used language. However, the assimilatory drift in bilinguals' production was temporary: native sounds showed a drift (back) toward the native norms four months after the SA. The results are discussed in light of recent studies suggesting that the amount of language use is a strong predictor of the authenticity in speech production.

Implicit or explicit? Examining verb bias learning through reversal

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Verb bias, the tendency for a verb to appear in certain syntactic structures, is an important statistic in language production. Novel verb biases can be learned by experiencing distributions of structures with particular verbs (see Coyle and Kaschak, 2008), but these learning mechanisms are not well understood, particularly whether such learning is implicit or explicit. Our studies taught novel verb biases and then without warning taught the opposite biases; an incremental implicit learning process cannot quickly learn the opposite bias. Participants were presented with training sentences containing one of three dative verbs (give, hand, show), or one of three transitive verbs (surprise, impress, please). Four of the verbs were biased, so that they appeared in only one structure and then only in the “opposite” structure. For example, ‘give’ might first consistently be double object dative in the first block, and then prepositional dative in the second block. Target trials, which assessed the influence of the training, were interspersed throughout each block. The crucial prediction from an implicit mechanism is that learning in the second block will be unsuccessful in comparison to that in the first block. One study used stem-completion primes and scrambled-word targets (adapted from Coyle and Kaschak, 2008), while the other presented training sentences using RSVP and assessed their recall (adapted from Potter and Lombardi, 1998). Both studies found that biased dative verb targets were more likely to match their training in the first block than in the second block (Study 1: $B1=.56$ matches, $B2=.5$, $p<.05$; Study 2: $B1=.125$ alternations/participant, $B2=.306$ alternations/participant, $p<.05$); no such effect was seen for transitives (active v. passive). This suggests that verb bias learning occurred only for biased dative verbs, and that this learning was implicit. The lack of learning for transitive verbs suggests that the active-passive alternation is not cued lexically.

Sentence production in a free word order language (Murrinhpatha)

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Psycholinguistic theories have been built on data from a very small percentage of the world's languages (< 1%, Norcliffe, Harris, & Jaeger, 2015), mostly European. This is problematic, since European languages are not representative of the full range of typological diversity and lack many features common to other language families. Here we report on preliminary findings from an on-going project investigating sentence production in Murrinhpatha, a polysynthetic language spoken in the Daly River region of Northern Australia. Along with many Australian languages, Murrinhpatha has been described as having very flexible word order (Walsh, 1976), although the evidence for this claim has until now been limited to grammatical descriptions and small-scale corpus studies. Thirty-two native speakers of Murrinhpatha described simple transitive events depicted on a computer while their eye-movements were recorded (following Norcliffe, Konopka, Brown, & Levinson, 2015). There were 48 target pictures, which fully crossed human and non-human entities in the agent and patient positions. Overall, the participants produced 1504 transitive sentences. All possible word orders were attested except VOS, with the most prevalent being SVO (45%), SOV (13%), and OVS (10%). NP accessibility significantly affected word order choice. Notably, participants were more likely to produce subject-initial sentences when agents were non-human and patients were human, and were more likely to produce object-initial sentences when agents were non-human. In contrast, verb-initial sentences were most common with human agents. The pattern of ellipsis suggested that human participants were most often unexpressed. Preliminary analyses on the eye-movement data suggest that: (i) the range of word orders available to Murrinhpatha speakers results in longer planning times, and (ii) like in verb-initial languages (e.g., Tzeltal), relational information between entities in a scene is encoded before describing it, although this may differ depending on whether the sentence is subject- or object-initial.

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**Oscillatory brain responses in language production following transient disruption
of the left middle temporal gyrus: A cTBS-EEG study**

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Language impairment is common after left-hemisphere stroke. However, the involvement of perilesional and homologous contralateral regions in compensating for left-sided lesions remains poorly understood. The aim of this study was to transiently disrupt the left middle temporal gyrus (MTG) and examine acute spatial changes in brain activity related to semantic processing and memory retrieval in healthy language production. In a randomized single-blind within-subject experiment, we recorded the electroencephalogram (EEG) from sixteen healthy, native Dutch speakers during a context-driven picture naming task. Participants read lead-in sentences that created a constraining (e.g. “He locked the door with the”) or a non-constraining context (e.g. “She walked in here with the”). The last word was shown as a picture which needed to be named (e.g. “key”). Prior to the task, participants received 600 pulses of either real or sham neuronavigated continuous theta-burst stimulation (cTBS) over the left MTG in two separate sessions in a randomized counterbalanced order. Thus, activity in the left MTG was temporarily downregulated following real stimulation. Replicating previous studies, participants were overall faster in naming pictures following a constraining relative to a non-constraining context, and this effect did not differ between real and sham cTBS. In contrast, real cTBS increased overall error rates compared to sham cTBS. Further replicating previous findings, we observed a robust decrease in alpha-beta (8-25 Hz) oscillatory power in the constraining relative to the non-constraining context prior to picture onset after participants received sham cTBS. However, this effect was attenuated and revealed a different spatial distribution following real cTBS, implying different neuronal generators of the scalp effects. Our findings provide evidence that immediately after the disruption of the left MTG, the lexical-semantic network is able to quickly reconfigure, but this reconfiguration may not be sufficient to mitigate performance decrements during word production.

Within-language interference and its control

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While there has recently been extensive research into executive function in bilingual speakers, the work on executive function and spoken language production within a single language has seen far less progress. This study aims to address this imbalance by examining behavioural evidence for the involvement of inhibitory mechanisms in object naming, particularly in situations of high selection demand, i.e. when two or more lexical candidates compete for the speaker's attention. We report data from eighty-nine unimpaired native English speakers who completed three standardised inhibitory control tasks (anti-saccade and arrow flanker with an embedded Simon arrow task) and two object naming tasks (picture word interference, PWI, and name agreement, NA), within which level of interference was manipulated. In addition, we assessed participants' language knowledge using the vocabulary subtest of WAIS-III. Performance on the arrow flanker and the anti-saccade tasks significantly predicted the magnitude of the PWI effect, but not the NA effect, accounting for 6% and 5% of its variance respectively. Performance on the Simon arrow task did not share a unique variance with performance on either of the verbal tasks. This pattern of results suggests that domain-general inhibition (i.e. at the level of perceptual processing, where one has to suppress conflicting sensory information) is involved in reducing semantic interference (i.e. at a central level of processing, where one has to deal with the co-activation of lexical competitors). General inhibitory ability remained a significant predictor of the speed with which speakers reduced semantic interference even after accounting for vocabulary knowledge (8% of the variance in the size of the PWI effect). The practical and theoretical implications of these results are discussed in relation to the various proposed sources of interference as well as the task impurity problem.

Production of grammatical gender agreement:

What can we learn from the differences between bilingual and monolingual speakers?

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Grammatical gender refers to the gender classification of inanimate nouns that entails agreement of associated sentential elements such as determiners and adjectives. It has been argued that speakers retrieve the gender classification of the noun from the lexical representation to produce grammatical gender agreement, subsequently computing the inflection based on morpho-phonological regularities. Hence, grammatical gender agreement may serve as a window onto the interface between lexical and morpho-syntactic processes in production. Here we focused on highly-proficient bilingual speakers, who are challenged with grammatical gender agreement, and examined how production in second language is affected by cross-language congruency.

Twenty-one native German speakers and twenty Russian-German bilinguals were presented with 216 pictures of inanimate objects selected from the MultiPic database (Duñabeitia et al., 2017). Masculine and feminine objects were selected such that the gender was congruent in Russian and German for half the objects and incongruent for the other half. Participants were asked to produce a noun phrase including the object name preceded by a determiner and an adjective in German (e.g., *'eine blaue Blume'*; *'a_[masc.] blue_[masc.] flower_[masc.]'*). Analysis of agreement errors on correctly named objects revealed no significant difference between bilingual and monolingual speakers, as expected for highly proficient bilinguals. However, a significant interaction revealed more agreement errors in nouns with incongruent compared to congruent gender for bilinguals, whereas monolinguals did not show such incongruency effect. Reaction time analysis showed a similar pattern.

The findings indicate that bilinguals may attain high proficiency in L2 generally producing grammatical gender agreement as fast and as accurate as native speakers, yet their performance is persistently susceptible to cross-language interference. Moreover, cross-language interference at the lexical representation of gender may affect the grammatical gender processing independent of successful lexical retrieval at the target language. Implications regarding models of bilingual language production will be discussed.

Influence of semantic association networks on the speed of word production across the lifespan

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Word production can be influenced by different psycholinguistic factors as well as by the age of the speakers. Studies usually show lower accuracy and slowed down production speed in elderly and children compared to young adults in picture naming^(1,2). Among factors likely underpinning age-related changes in word production, semantic variables may constitute a key point⁽³⁾. There is no unique consensus on which semantic variable has the largest influence on word production, but semantic association is considered crucial for determining the structure of the mental lexicon^(4,5). In the present study, we investigate whether (age-specific) lexical-semantic networks predict the speed of word production at different ages.

Collection of associative norms: 120 French native speakers aged 10 to 80 and divided into 6 age-groups (10-13; 16-18; 20-30; 40-50; 58-68; 69-80) participated in this data collection. Subjects had 10 seconds to give all associate words that came to mind for each of the 204 cue words. Mean number and density of free associates given for each cue word were calculated for each age-group.

Picture naming task: 120 other French native speakers divided into the same six age-groups, participated in a picture naming task involving 120 pictures and their corresponding modal names, for which classical psycholinguistic variables were available from two French databases^(6,7) in addition to the collected age-related associative norms. Production latencies (RT) and Accuracy were measured.

Lower Accuracy and slower RTs were found in the younger and the older participants. Associates given by younger and older participants were lower in density and number. Crucially, age-related semantic associations predicted, in some groups, naming RTs better than other semantic variables (e.g. semantic features⁽⁸⁾).

Coherent with the observation that “semantic networks” evolve in terms of size and density across the lifespan, our results suggest that it also influences word production latencies in picture naming.

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Lexical access on behalf of task partner: Electrophysiological insights from joint picture naming

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When naming a sequence of pictures, naming latencies increase with each new picture of a given semantic category, so-called cumulative semantic interference (e.g., Howard et al., 2006). Recently, it has been demonstrated that naming latencies not only increase in response to speakers' own prior naming of pictures, but also in response to their task partner naming pictures (Hoedemaker, Ernst, Meyer, & Belke, 2017; Kuhlen & Abdel Rahman, 2017). Here we investigate the electrophysiological underpinnings of this effect. EEG was recorded from 30 participants who believed to be naming pictures together with a remotely located task partner. We observed an increased posterior positivity around 250-400ms, which corresponds to an increase in naming latencies and has been taken to reflect lexical selection (Costa, 2009). Unlike previous studies, only a subset of subjects showed partner-elicited interference. Crucially, this group of subjects showed a stronger increase in posterior positivity when semantic categories were co-named with the partner (vs. named alone), and only these subjects showed a similar posterior positivity when the partner named a picture (vs. when nobody named it). This suggests that these subjects simulated lexical access on behalf of their partner. In conclusion, our study connects partner-elicited cumulative semantic interference to electrophysiological underpinnings, yielding promising insights into the processes of language production in social settings.

Semantic context effects in word production play a role up to response initiation

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I report an ERP study on neural correlates of conceptualising before speech using word categorisation and function naming tasks. Target words were named with either their category level word or their function. They were presented with context pictures that were categorically and functionally related to the target (C+F+ e.g., car – motorbike: category vehicle, function to drive), only categorically related (C+F- e.g., car – boat: category vehicle, functions to drive and to sail), or unrelated (C-F-). The behavioural results replicate previous findings showing that C+F+ picture-words pairs induce facilitation in both tasks whereas C+F- picture-word pairs only induced facilitation in the categorisation task. Therefore, pictures that are response congruent induce facilitation, an effect that was previously shown to be substantially larger than semantic facilitation (e.g., by spreading of activation). The ERP results showed that only in the C+F- condition, the frontocentral N2 was more negative in the function than the categorisation task. Given that the N2 is associated with conflict monitoring, this shows that already at 200ms after stimulus onset, a conflict monitoring response was triggered by whether or not the stimulus pair was response congruent or not. Further, the N400 was unaffected by task and only reflected the ease of semantic integration of the stimulus compound. By contrast, the parietal Late Positive Component (LPC) was modulated by the semantic relation between target and distractor, albeit differently in each task. The C+F- condition drove this interaction since the LPC was more positive in the function than categorisation task whereas no task differences were observed in the other conditions. Correlation analyses between ERP modulations and RTs revealed that only LPC amplitude correlated with RTs even though the N2 modulation showed the same response pattern and the LPC. Therefore, the response pattern observed in RTs appears established around 600ms after stimulus onset, which is well before average response initiation (~ 950ms). Overall, these results show that semantic context effects play a role in preparing a verbal response close to the initiation of the motor response. Surprisingly, even though response conflict was quickly detected, its influence carried on up until the end of observable semantic effects approx. 350 ms prior to response onset. These findings suggest the stages word production may be overlapping more than assumed in strict serial models.

Time course and neural signature of speech phonetic planning as compared to non-speech motor planning

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The relationship between speech abilities and non-speech oral abilities has been discussed for many years given that they share the same anatomical structures. However, it is only recently that the speech motor control literature has investigated whether they share the same neural substrates (e.g. Salmelin & Sams, 2002; Price, 2009). A clear notion of the link between speech and non-speech systems is relevant for comprehending the human motor behavior in general and speech motor planning in particular, as well as to understand motor speech disorders. Here we capitalize on the comparison between the production of speech and non-speech oral sequences to investigate the dynamics of the “latest” stages of speech production processes, where the linguistic message is transformed into the corresponding articulated speech. In order to separate linguistic encoding from speech encoding, we used a delayed speech and non-speech production task, where speakers prepare an utterance, but produce it overtly only after a cue appearing after a short delay. Additionally, to avoid the preparation of the phonetic speech plan within the delay, it was filled with an articulatory suppression task in half of the participants (Laganaro & Alario, 2004). We compared, both behaviorally and on EEG/ERPs, the production of voluntary non-speech vocal tract gestures to the production of French syllables. Non-speech gestures and syllables were matched as close as possible in terms of acoustic and somatosensory targets. Behavioral results show no significant difference in the accuracy of speech vs. non-speech production. However, reactions times were significantly longer for the non-speech production task, as compared to the production of syllables, only when the delayed production was filled with an articulatory suppression task: in this condition, ERP results show extended differences in amplitude between speech and non speech in several time windows.

Learning structural alternations: What tells learners how to generalize?

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How do learners acquire and generalize knowledge about structural alternations based on limited input? One possibility is that learners are verb-wise conservative, i.e., they largely restrict their use of structural alternations to verbs that they have experienced them in. The opposite is that they generalize all alternations across all verbs. Yet another possibility is that they are sensitive to semantic properties of verbs (i.e., narrow conflation class; “give” and “hand” belong to the same class as they imply transfer, while “show” does not) and generalize to within-class verbs only.

English monolinguals described “give”, “hand”, and “show” dative events in a Korean-English hybrid language. The language was constructed with Korean word order, case markers, and verbs, but English nouns. In the exposure phase, all subjects saw structural alternations only in “give” sentences. The non-scrambling group was exposed to the canonical order (NOM-DAT-ACC) and an alternation inside verb phrases (NOM-ACC-DAT). The scrambling group was exposed to scrambling (DAT-NOM-ACC) in addition to the orders shown to the non-scrambling group. Both groups saw only the canonical order for “hand” and “show”. In a subsequent picture description task with novel pictures, scrambling group learners produced the alternated structure (NOM-ACC-DAT) equally often with all verbs, but non-scrambling group learners produced the alternated structure more with “give” than with other verbs (interaction $p < .05$). The analogous pattern was found in a subsequent acceptability judgement task (interaction $p < .05$). Thus, learners were verb-wise conservative only when they saw no scrambling (i.e., when they saw no evidence that the structural alternations occur outside verb phrases). We found no evidence suggesting an effect of narrow conflation class. In conclusion, learners do not merely track statistical patterns in the input, but use internal linguistically sophisticated biases to generalize structural alternations.

The effects of socially shared information on semantic context facilitatory effects

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Natural speech rarely occurs in isolation of social context. In dialogues, interlocutors usually establish mutually shared knowledge to enable successful conversation. Yet how socially shared information influences lexical-semantic processing remains largely unknown. In the semantic blocking paradigm, subjects name pictures repeatedly under two conditions: blocked by a specific semantic category (homogeneous condition) or not (heterogeneous condition). Naming latencies in repetitions after the first presentation are significantly longer in the homogeneous relative to the heterogeneous condition, known as semantic interference. Similar patterns have been observed when the stimuli are from different categories but perceived as having a common theme, a.k.a. ad hoc semantic interference. Here we examine whether subjects show partner-elicited semantic interference when they name objects for presumed task partners. Stimuli are either blocked with those sharing a common theme or those belonging to different thematic groups. Before the naming session, subjects watch a video of a partner who talks about the theme of the stimuli in the homogeneous condition. Subjects go through five naming sessions, i.e. name pictures for five partners. We hypothesize that the priming of partners' thematically-relevant narratives on the stimuli will induce ad hoc semantic interference similar to that caused by hard-wired semantic categories. We expect stronger semantic interference in the thematically-homogenous versus thematically-heterogeneous condition. Subject-reported homogeneity of the stimuli confirms the validity of our manipulation. To the contrary of our expected findings, preliminary results (19 out of 32) indicate the opposite finding: subjects seem to experience less interference when partners' narratives indicate the common theme among the objects. A follow-up experiment will elucidate whether the perceived homogeneity is elicited by the video narratives by having participants listen to videos that are unrelated. We will discuss the implications of these findings in the light of current theories of speech production and language in interaction.

**Articulatory and acoustic latency indices of articulatory level effects in the
naming of monosyllabic stimuli**

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Given that articulation represents the final link in a very long processing chain within Levelt's (1989) model of speech production, articulatory level effects can potentially cloud our understanding of what occurs in antecedent processes. To this end, we describe a simple and affordable approach which combines video and audio recordings to index articulatory level effects in the naming of monosyllabic stimuli. In the current study, we measured the articulatory and acoustic latencies of syllables, beginning with various simple and complex onsets and ending with the vowel /ə/, produced in a speeded naming task. Some of the key findings of the current study include: 1) significant effects of place of articulation as well as voicing on both articulatory and acoustic latencies, 2) effects of manner and onset complexity on acoustic latency, but not articulatory latency, and 3) effects of initial oral configuration and the place of articulation on the sensitivity of the articulatory latency measure. These findings highlight just some of the factors that researchers have not considered when designing their experiments and selecting their stimuli, as well as when interpreting new and existing results. In addition, further examination is needed to determine whether these effects are constant or variable under different speaking situations with differential processing demand.

Semantic interference and morphological facilitation in noun-noun compound production:

Evidence from event-related brain potentials

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We examined how compounds are lexically stored and processed during speech production. Predictions of the sequential two-stage model, which assumes sequential access to holistic compound lemmas and morpheme-based form representations (Levelt et al., 1999), and its modifications (e.g., ‘multiple-lemma representation account’, Marelli et al., 2012) were tested. Using a picture-word interference paradigm, distractor words were superimposed onto pictures that were named with compound words.

Distractors either overlapped with the compound’s first or second constituent (sun / flower -> sunflower), were categorically related to the compound (tulip-> sunflower), or to its first constituent (moon-> sunflower). In addition to picture-naming latencies, the continuous electroencephalogram (EEG) was extracted. Speech artefacts in the EEG signal were eliminated by using residue iteration decomposition (RIDE; Ouyang et al., 2016), and event-related brain potentials (ERPs) were analysed. Naming latencies confirmed morpho-phonological facilitation for both constituents of compound targets, and semantic interference for compound-related distractors. However, no effects were obtained for distractors that were semantically related to the first constituent of the compound. The EEG data complement the behavioural findings: For distractors from the same category as the compound, a posterior positivity was evident in an early time window (225-400 ms post picture onset), which might reflect lexical-semantic processes in speech production (semantic interference). Distractors from the same category as the compound’s first constituent showed no such effect, supporting single, holistic compound lemmas. The morphological distractors produced a positivity at midline electrodes, which might reflect facilitation of morpho-phonological encoding. Effects of first-constituent distractors overlapped temporarily with the semantic effect for the whole compound.

In contrast, the positivity induced by second-constituent distractors started approximately 75 ms later, and was followed by a frontal negativity. Our data corroborate single-lemma, but multiple-morpheme representations for compounds in production. The time-course information will be interpreted in the framework of current accounts.

Opening a file drawer –

Surprisingly robust evidence for semantic interference from distractor pictures in picture naming

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Semantic context effects in picture naming tasks have been decisive in devising and evaluating current models of word production. By now, there is overwhelming and long-standing evidence that semantic-categorically related distractor words (presented visually or auditory) slow picture naming more strongly than unrelated distractor words (e.g., “dog” vs. “bell”, when the target picture shows a horse; picture-word interference paradigm). More recently, this has also been demonstrated for environmental distractor sounds (e.g., barking vs. ringing; picture-sound interference paradigm). In contrast, the extant literature suggests that, in the absence of additional specific features of the experimental procedure, this does not hold for distractor pictures (picture-picture interference paradigm). This seeming absence of a corresponding effect has been very influential in the theoretical debate. Over the years, we have been collecting data with the picture-picture interference paradigm in various contexts, with different item sets, and a large number of participants, partly as control experiments in which we expected no semantic effects to arise.

However, in these experiments converging and highly consistent evidence in favour of semantic interference from distractor pictures in simple picture-picture interference tasks has accumulated and we present this body of evidence here. Our experiments differed on a number of variables (e.g., spatial arrangement, visual similarity, and stimulus realism of target and distractor, response set membership of the distractor), but neither of these factors appears sufficient to explain the emergence of semantic interference. These results are therefore in contrast to previous simple picture-picture interference studies which had found no solid evidence in favour of semantic interference. It is as yet not clear how to account for this discrepancy. However, the present data suggest that the existence of such an effect ought to be appreciated when further developing word production models.

Predictability effects and lexical diversity in sentence completion by younger and older adults

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Age-related changes are observed at all language processing levels, including lexical access, but their mechanisms are still debated. According to the inhibition deficit theory (Burke, 1997), age-related changes in lexical access can be due to decline of inhibition with age: older adults have greater difficulty suppressing the most salient or automated lexical activations when attempting to activate target lexical items.

We tested the above prediction using a sentence completion task. 86 younger (18-32 y.o.) and 86 older (59-82 y.o.) adults had to complete 120 Russian sentences with a semantically appropriate final word.

Sentences varied in predictability of the final word: some had a highly predictable completion, whereas others could have numerous possible completions and thus required to select one response and inhibit others. Older adults used less diverse completions than younger adults (H-statistics: $t(119)=6.55, p<.001$): it appears that they preferred to endorse more automatically activated completions, whereas younger adults inhibited them in favor of more distantly related alternatives. In addition, lower predictability of the final word (as measured post-hoc) caused a greater slowing in older than younger participants ($F(1,170)=37.87, p<.001$): older adults were particularly challenged by conditions of lexical access requiring to select between multiple options competing for activation.

Older adults' increased difficulty with selection and inhibition demands in lexical retrieval is consistent with the inhibition deficit theory. But the results can also be accounted for by older adults' tendency to spare limited cognitive resources and show lower engagement into cognitively demanding tasks (Brebion, 2003; Hess, 2014; Hess et al., 2016). Possibly, they used different lexical retrieval strategies than younger adults, endorsing less costly activations whenever task allows, in order to spare limited cognitive resources and avoid cognitive fatigue.

Iconicity matters:

Signers and speakers view spatial relations differently prior to linguistic production

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In sign languages, spatial encodings are iconic and analogue to the real event (Emmorey, 2002). Signers mostly use visually motivated form-to-meaning mappings to refer to spatial relations by choosing certain handshapes to classify sets of objects and placing them in signing space. However, in spoken languages spatial encodings are arbitrary and categorical. Although previous research suggests that cross-linguistic variability in encoding spatial events guides visual attention to event components differently prior to language use (e.g., Papafragou et al., 2008), it is unknown whether this also holds for cross-modality differences.

We used a visual world production eye-tracking paradigm to compare signers' and speakers' visual attention to *left/right* configurations prior to spatial descriptions. The question was whether signers pay more sustained visual attention than speakers to contrasting spatial relations. This might be due to signers' visually iconic encodings that resemble the symmetrical configuration of *left/right* relations in the presented pictures, however, speakers' arbitrary and categorical encodings do not.

We tested 20 Dutch speakers and 19 native signers of Sign Language of the Netherlands and presented them with displays of four pictures. Each picture contained the same two objects, but in different spatial relations to each other. Participants described the target picture highlighted by an arrow. Experimental conditions contained left and right configurations in one display (i.e. target: left, contrast competitor: right). We predicted that prior to spatial descriptions, signers would look more at the contrast competitor compared to the target than speakers.

Using linear mixed-effects regression models, our results demonstrated that over time, signers' contrast competition increased (more looks to contrast competitor versus target), while speakers' contrast competition decreased (less looks to contrast competitor versus target). These results provide first evidence that the modality of spatial encodings influences visual attention to contrasting spatial relations prior to language production.

Self-produced speech rate is processed differently from other talkers' rates

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Interlocutors perceive phonemic category boundaries relative to talkers' produced speech rates. For instance, a temporally ambiguous vowel between Dutch short /A/ and long /a:/ sounds short (i.e., as /A/) in a slow speech context, but long in a fast context. Besides the local contextual speech rate, listeners also track talker-specific habitual speech rates (Maslowski et al., in press). However, it is yet unclear whether self-produced speech rate modulates perception of another talker's habitual rate. Such effects are potentially important, given that, in dialogue, a listener's own speech often constitutes the context for the interlocutor's speech. Three experiments addressed this question. In Experiment 1, one group of participants was instructed to speak fast, whereas another group had to speak slowly (16 participants per group). The two groups were then compared on their perception of ambiguous Dutch /A/-/a:/ vowels embedded in neutral rate speech from another talker. In Experiment 2, the same participants listened to playback of their own speech, whilst evaluating target vowels in neutral rate speech as before. Neither of these experiments provided support for the involvement of self-produced speech in perception of another talker's speech rate. Experiment 3 repeated Experiment 2 with a new participant sample, who were unfamiliar with the participants from the previous two experiments. Here, a group effect was found on perception of the neutral rate talker. This result replicates the finding of Maslowski et al. that habitual speech rates are perceived relative to each other (i.e., neutral rate sounds fast in the presence of a slower talker and vice versa), with naturally produced speech. Taken together, the findings show that self-produced speech is processed differently from speech produced by others. They carry implications for our understanding of the link between production and perception in dialogue.

Codability and sociolinguistic variants: How do we select between dialectal alternatives?

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Bidialectal speakers, namely people who speak multiple regional dialects, often have distinct object names in their two dialects, e.g., *elevator* (US) / *lift* (UK). Hence, dialects introduce a novel type of socially-constrained synonym which can inform our understanding of lexical selection processes. Specifically, while it is well known that pictures with synonymous labels (low codability, e.g., *sofa/couch*) are named more slowly than pictures with only one valid label (high codability, e.g., *banana*; Vitkovitch & Tyrrell, 1995; Alario et al, 2004), it is unclear whether this effect would apply to dialectal alternatives, especially when the dialectal alternative is known by the speaker but rarely used. The question asked here is, how is socially-constrained lexical selection achieved? More specifically, we ask whether dialectal alternatives compete for selection with the preferred labels.

In two experiments, a picture naming experiment (Exp 1) and a referential communication task (Exp 2), British participants named pictures with either high codability (*banana*), low within-dialect codability (*sofa / couch*), or low between-dialect (UK/US) codability (*lift / elevator*). Preferred picture labels were matched for relevant lexical and semantic features.

We compared picture naming times and lexical selection outcomes across picture types. Both within- and between-dialect low codability pictures were named more slowly than high codability pictures. Furthermore, participants only produced American outcomes when previously exposed to them in the referential communication task; spontaneous productions of American outcomes were rare. The results suggest alternative picture labels compete for selection even when sociolinguistically inappropriate to the context and rarely used by the participant. This result will be discussed in the context of bilingual lexical selection and the parallels between translation equivalents and dialectal alternatives.

Filling the gap in gap-filling: Long-distance dependency processing in sentence production

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In long-distance dependency processing, comprehenders fill gaps before those gaps become apparent in the bottom-up input, before encountering gap-hosting verbs. Here we show that speakers plan the gap before the production onset of *wh*- questions, and that this gap-planning precedes the planning of gap-hosting verbs.

Participants ($n = 48$) were first syntactically primed for the presence or absence of *that*, and then described pictures using sentences like the following:

(1) *Who does the artist think (*that) is chasing the ballerina.*

(2) *Who does the artist think (that) the chef is chasing.*

When speakers were primed with *that*, they were expected to exhibit processing difficulty in (1) but not (2), because the primed *that* conflicts with the that-trace constraint (Perlmutter, 1971). We tracked the entire time-course of sentence production by measuring speech onset and word-by-word production time. Critically, the timing of this “adverse *that*-priming effect” should correspond to the latest time point by which speakers plan the gap. In the same experiment, we also superimposed distractor words that were either semantically related (e.g., *stalk*) or unrelated (e.g., *kiss*) to the gap-hosting verbs, in order to estimate the planning timing of gap-hosting verbs.

In the *that*-primed condition, speakers were slower to start speaking the subject extraction sentences, but not object extraction sentences (interaction $p < .05$, replicated twice in the relative-clause version of similar experiments). In comparison, speakers were slower to say *is* due to the semantically related distractor ($p < .05$). These results suggest that speakers planned the gap before the sentence onset, and before they plan the gap-hosting verbs. We suggest that long-distance dependency processing in comprehension and production share the same top-down, verb-independent structure building process.

Does gesture observation affect action picture naming?

Evidence from unimpaired speakers and people with aphasia

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In daily communication, gestures can be used to convey meaning that supplements or replaces spoken language. Gestures have been primarily investigated when they co-occur with speech, where tight interactions between gestures and speech have been demonstrated. However, evidence is lacking regarding the influence on language of gestures produced alone (i.e., pantomimes). The extent to which gesture may influence lexical retrieval remains almost unknown. This study investigated how pantomime observation affects action picture naming in unimpaired speakers (n=36) and in people with stroke-induced language impairment (aphasia; n=10).

Participants were asked to name an action picture immediately after viewing a congruent gesture (e.g., *drinking_{gest}* – *drinking_{pic}*), an unrelated gesture (e.g., *pushing_{gest}* – *drinking_{pic}*) or a neutral (non-gesture) prime.

In both groups of participants, gesture prime condition significantly affected response latencies (unimpaired speakers: $\chi^2(2) = 56.7$, $p < .001$; people with aphasia: $\chi^2(2) = 76.8$, $p < .001$). Participants were faster to name the action pictures when preceded by a congruent gesture, compared to an unrelated gesture or a non-gesture. Crucially, there was no difference in latency between the unrelated gesture and non-gesture conditions. These results support the conclusion that there was facilitation of naming by the congruent gesture.

This study provides new evidence for cross-modal priming of verb retrieval in picture naming from the observation of gestures and is in line with literature supporting an interaction between gesture and word production systems (e.g., de Ruiter, 2000; Krauss et al, 2000; McNeill, 2000). Drawing from the theoretical accounts in the literature (e.g., Collins & Loftus, 1975; Wheeldon & Monsell, 1992), we suggest that facilitation of action naming from a gesture is consistent with priming at either the semantic (due to overlapping semantic features) or lexical levels. Further research is necessary to further test these hypotheses and specify the mechanism through which gesture observation impacts on lexical retrieval.

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Development of shared syntactic representations in second language learning:

Evidence from syntactic priming

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Two longitudinal studies investigated the development of syntactic representations in late second language (L2) learners by means of syntactic priming in an artificial language (AL) paradigm. Several studies found that L2 learners are primed by syntactic structures of one language, when producing in the other language. These findings suggest that L2 learners develop shared syntactic representations between languages. But how are these representations established? Hartsuiker and Bernolet's (2017) theory claims that 1) L2 syntactic representations evolve gradually from item-specific to more abstract, and 2) over time these representations are increasingly integrated with available L1 presentations.

We tested the theory's predictions with native Dutch speakers, who acquired the AL in the lab by means of a battery of tasks, the last of which was a sentence priming task. The AL syntax resembled the Dutch syntax. We manipulated the relation between prime and target to investigate whether syntactic priming occurred in conditions with meaning overlap (item-specific) as well as in conditions without overlap (abstract).

In Study 1, target sentences were always in the AL. There was a priming effect in both item-specific and abstract conditions (though smaller) from Day 1 on. In Study 2, the AL was more difficult (but still resembling Dutch syntax), and target sentences were either Dutch or the AL. The results were very similar to those of Study 1. For ditransitive structures, however, there was already L1-L2 priming on Day 1, but L2-L1 priming was not present before Day 2. This is probably because ditransitive structures in Study 2 differed slightly from their Dutch equivalent. These findings suggest that a) cross-linguistic priming is not necessarily symmetric, in contrast to the theory's predictions, and b) at least for structures that are very similar between languages, both item-specific representations and more abstract representations are established very early during language learning.

The role of metrical stress in phonological encoding during speech production

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Word durations tend to lengthen in difficult-to-produce contexts (e.g., Kahn & Arnold, 2012). Scene description experiments show that speakers lengthen target words when previously uttered words share initial phonological segments (e.g., *The canoe shrinks. The candle flashes*). The general claim is that lexical competition between similar sounding words creates interference that slows selection of phonemes in the second word (i.e., candle; Yiu & Watson, 2015). In two experiments, we investigate whether interference can also be induced by metrical similarity. Such an effect would suggest that phonological planning includes abstract representations for metrical structure. In Experiment 1, participants completed an event-description task in which disyllabic target words shared segmental overlap with a prime word, and either had matching stress (e.g., *The butter shrinks. The button flashes*) or non-matching stress (e.g., *The baton shrinks. The button flashes*). Participants lengthened words more in trials with both segmental and metrical overlap, compared to trials with segmental overlap alone. This lengthening could either be the result of metrical interference or having uttered a prime with similar acoustic stress. To adjudicate between these possibilities, Experiment 2 included the same conditions as Experiment 1, as well as segmentally distinct word pairs with either matching stress (e.g., *The pickle shrinks. The button flashes*) or non-matching stress (e.g., *The cigar shrinks. The button flashes*). Participants again showed lengthening in trials with both segmental and metrical overlap, but no lengthening from metrical overlap alone. These data suggest that acoustic similarity between initial phones in prime and target words, in addition to segmental overlap, leads to lengthening. Results are discussed in the context of production models based on a speakers' auditory memory of the conversation (Jacobs et al., 2015).

Timing and selective attention in self-monitoring

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We test some predictions derived from a computational implementation (Hartsuiker & Kolk, 2001) of the dual perceptual loop theory of self-monitoring (Levelt 1989). Main predictions are the following: (1) Distributions for both word initial and word medial consonant errors of error-to-cutoff times are truncated close to zero ms, with the virtual peak of the truncated distributions corresponding to zero ms; (2) Distributions of cutoff-to-repair times for both initial and medial consonant errors are censored at zero ms, with no difference between initial and medial consonant errors in the estimated peaks. (3) Within both spoken words and spoken utterances rate of error detection decreases from earlier to later. These predictions were tested in a four-word tongue-twister experiment eliciting interactional segmental speech errors in initial and medial consonants in two-syllable CVCVC Dutch words. Results show that (1) Error-to-cutoff times are truncated close to zero ms, but the peak of the distribution does not correspond to zero ms, but to the low end of the distribution. This implies that after internal error detection interrupting takes more time than speech initiation. (2) Cutoff-to-repair times are censored at zero ms, but the relative number of cutoff-to-repair times of zero ms is significantly lower for medial than for initial errors. This means that on average repairing takes longer for medial than for initial errors. (3) Rate of error detection is lower for medial than for initial consonant errors and decreases from the first to the fourth word in the utterance. This suggests that selective attention for self-monitoring decreases from earlier to later both within words and within utterances. These findings confirm some major properties of the Hartsuiker and Kolk implementation of Levelt's model, but also show that in quantitative details the model can be improved on.

Endogenous competition in normal word production

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Do algorithms underlying normal language production compel a speaker to select the very best word for a given concept, or merely a good word? Competitive accounts assume that speakers must resolve competition between coactivated words before production can proceed, and thus predict slowing in the presence of stronger alternatives. Most empirical evidence for such competition, though, comes from paradigms that artificially apply exogenous competition (e.g. PWI). The scant evidence for competition from endogenous alternatives comes from name agreement effects in picture naming norms, wherein alternative names are almost invariably assumed to slow dominant name retrieval. However, a recent finding challenges that interpretation: after controlling for dominant name agreement, speakers actually name pictures faster when they face endogenous competition from stronger alternatives (i.e. higher *secondary name agreement*; Oppenheim, in prep), implying little if any role for competition in normal lexical selection.

One might, however, imagine that high secondary name agreement is associated with idiolect- or dialect-bound alternatives, such that speakers do not actually consider all of the options observed in their larger linguistic communities. If so, the crucial test case would be a speaker who uses both dominant and secondary names for the same picture, when retested in separate sessions: if competition hinders normal lexical selection, their inhibition from strong secondary names should be greater. Here I test this possibility with two repeated norming datasets (Balatsou, Fischer-Baum, & Oppenheim, in prep; Blazer, Balatsou, & Oppenheim, this conference). Participants named 525 drawings from the IPNP in two or three sessions, one week apart. Linear mixed effects regressions of Session 1 dominant naming latencies replicate the finding of facilitation from strong secondary names, demonstrating it is at least as strong for speakers who use those secondary names in future sessions, and thus ruling out a strong role for endogenous competition in normal word production.

Production patterns in the language and gesture of time expressions

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The co-occurrence of linguistic expressions with patterns from other modalities, especially gesture, is producing very important insights into the cognitive processes that underlie language production (McNeill 2000). However, quantitative studies of gesture co-occurring with specific linguistic expressions are practically non-existent, since it is hard to obtain a large sample of authentic utterances of the same linguistic expression.

To bridge this gap we extracted our data from NewsScape, a dataset of television broadcasts from over 50 networks, with around 400,000 hours of video and totaling 2.5 billion words of aligned closed-captioning in 17 languages. NewsScape is developed by the Red Hen Lab, an international research consortium (Steen et al., 2018). The search tools for NewsScape's vast repository of subtitles (Uhrig, 2018) render hits in the shape of video clips where a speaker is uttering the linguistic structures searched, thus allowing for the examination of the multimodal information accompanying the production of specific utterances.

To study how time phrases are associated to gestural patterns (Casasanto & Jasmin, 2012; Núñez et al., 2012; Núñez & Sweetser, 2006; Walker & Cooperrider, 2015), we examined over 8000 video clips with four types of time expressions in English (as classified by Núñez & Cooperrider, 2013): sequential (e.g., earlier/later than), deictic (back in those days, in the distant future), and demarcative (from beginning to end). The majority of cases included gesture directly linked to the semantics of the time expression. We also examined the correlation between sagittal, lateral, or vertical gesture and the types of time expressions, as well as the congruity between the spatial information provided by language and gesture. The high frequency of co-occurrence between verbal and gestural patterns and the nuanced semantic connections found provides insight into the multimodal nature of language production.

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Effects of phonological neighbourhood density and frequency in mono- and bilingual speakers with aphasia

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When a bilingual is speaking in one language, words of the other (non-target) language are activated¹. However, there has been little investigation of whether similar sounding words in the non-target language (*cross-language phonological neighbours*) influence production. Findings to date are inconsistent, with no effects, or facilitatory effects of *phonological neighbourhood density* (PND) for unimpaired bilingual speakers^{2,3,4}. No research has examined bilingual speakers with aphasia (BwA), but findings for monolingual speakers with aphasia (MwA) show that high PND can result in overall better accuracy⁵, fewer omission errors⁶, and/or more articulatory errors⁷. However, phonological neighborhood *frequency* (PNF) has not been controlled for in most studies and therefore may be an overlooked variable that could account for some of the inconsistent evidence.

This study aimed to extend the investigation of the influence of PND *and* PNF to BwA, while collecting further evidence for MwA, using a case series design^{8,9}. One Italian-English BwA, who showed equal proficiency pre-morbidly for both languages, and three Australian-English MwA participated; all of whom presented with spoken word finding difficulties but preserved comprehension (stroke onset > 1 year). Participants were required to name 244 pictures¹⁰ of objects with high cross-linguistic name agreement (> 85%). Responses were used to examine latency, accuracy and error type, using within- and, for the BwA, across-language PND and PNF as predictor variables (calculated using CLEARPOND¹¹), while controlling for log frequency, number of phonemes, imageability, age-of-acquisition, and visual complexity.

Logistic and multiple regressions indicated that PND and PNF had no significant effect for MwA (all *ps* >.1). A facilitatory trend was observed for the BwA, showing a marginal within-language effect for PNF in English (*p* = .07), and for PND in Italian (*p* = .063). Cross-language PND and PNF effects were not observed (*p* >.1). Theoretical implications will be discussed in current production models^{1,12}.

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Structural priming in language production: The case of the German passive

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The tendency of speakers to reuse a previously processed structure has been found for different linguistic structures in different languages. The relevance of these *structural priming* experiments has recently been reinforced by Branigan & Pickering (2017), who claim that they might provide us with evidence about linguistic representations. To do so, the actual effect of structural priming has to be disentangled from further influences on sentence production (e.g. *inherent accessibility*).

One of the most investigated alternations is the active/passive alternation. In German, priming studies have mainly focused on ditransitive verbs. If structural priming is the robust mechanism it has been claimed to be and priming might even be enhanced for less preferred structural alternatives, we expect to find structural priming of the German passive. Curiously, there are no published results showing this effect.

In my experiment, I investigated passive priming in a picture description paradigm (+ recognition task) using photographs of persons acting in real-life situations. Variables that have been found to influence structural priming and/or sentence production were included to stimulate the production of non-canonical structures; verb repetition (i.e. *lexical boost*) and the *animacy* of the patient.

The results of 30 participants show a main effect of prime; speakers are structurally primed by passives. They also show a main effect of animacy; changing the voice of sentences is a valid structural option for speakers of German to promote more accessible referents in production.

With this starting point, it is a future task to successively eliminate influences on sentence production to extract the actual structural priming effect to unambiguously use it in the sense of Branigan & Pickering (2017).

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Phoneme as a planning unit in Chinese spoken language production: Evidence from ERPs

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Recent studies have suggested that language rely differentially on different phonological planning units in spoken word production. Speakers of alphabetic languages use phoneme as primary processing unit when they produce words, whereas syllable constitutes primary units of phonological encoding for speakers of Chinese in which the orthographic system does not code explicitly for phonemes. The question arises, then, as to whether phonemic representations also play a role for Chinese speakers. In the current experiment, we used event-related potentials combined with the form preparation task to investigate this issue. Chinese speakers named pictures which were blocked by initial phoneme overlap so that picture name shared the initial phoneme or were phonologically unrelated in a block. Whereas naming latencies were unaffected by phoneme overlap, ERP responses were modulated from 240-300 ms after picture onset. We interpret these results as evidence for the claim that phonemic segments constitute fundamental units of phonological encoding in Chinese spoken word production.

Running or speed-walking? Simulations of speech production at different rates

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That speakers can vary their speaking rate is evident, but how they accomplish this has hardly been studied. Consider this analogy: when walking, speed can be continuously increased, within limits. However, to speed up further, humans must run. Are there multiple qualitatively distinct ‘gaits’ in speech planning that resemble walking and running? Or is control achieved by continuous modulation of a single gait?

This study investigates these possibilities through simulations of a new connectionist computational model of the cognitive process of speech production, derived from Dell, Burger and Svec’s model (1997, *Psychol. Rev.* 104(1), 123). Our model mimics the temporal characteristics of observed speech.

The model has parameters that can be adjusted to achieve a specific speaking rate. During training, different clusters of parameter values (regimes) are identified for different speech rates. We consider the parameters as dimensions of a high-dimensional ‘regime space’, where different regimes occupy different regions.

In a one gait system (‘speed-walk’ to speak faster) the regimes used to achieve fast and slow speech are qualitatively similar, but quantitatively different. In regime space, they would be arranged along an axis. In a multiple gait system, (‘walk-speak’ for speak slower, ‘run-speak’ to speak faster), the regimes would be dispersed, with no obvious relationship between the regions associated with each gait, and an abrupt shift in parameter values to move from ‘walk-speaking’ to ‘run-speaking’.

After training, the model achieved good fits in all three speaking rates, and the parameter settings associated with each speaking rate were different. In regime space, the broad arrangement of the parameter settings for the different speaking rates was non-axial, suggesting that ‘gaits’ may be present in the speech planning system. Thus, we provide the first computationally explicit connectionist account of the ability to modulate the speech production system to achieve different speaking styles.

150 years after Donders: Replication and modeling of his speech production latencies

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Speech production latencies were first measured 150 years ago. On 21 August 1865, Donders conducted his seminal experiments with the a-, b-, and c-methods using a speech repetition task, reported in his classic article (Donders, 1868). Under the a-method, subject A spoke a known syllable (i.e., “ki”) and subject B had to repeat it as quickly as possible, under the b-method one of several syllables (i.e., “ki”, “ko”, “ke”, “ku”, or “ka”) was spoken and had to be repeated, and under the c-method one of several syllables was spoken but only a specific one (i.e., “ki”) had to be repeated. Subtracting the reaction time for the a- from the c-method was taken to give the discrimination duration, and subtracting the time for the c- from the b-method gave the choice duration. The discrimination and choice durations for Donders himself were about equal. Wundt (1874) and Cattell (1886) criticized the c-method by arguing that it also involves a choice, namely whether or not to respond. Donders expressed a different concern, namely that the c-method may not involve full discrimination. My analysis of unpublished data from Donders’ laboratory notebook on the performance of his students supports the concern of Wundt and Cattell rather than Donders. Moreover, my recent replication of Donders’ experiment using his original stimulus lists revealed a much larger discrimination than choice duration for myself, in line with the concern of Wundt and Cattell. Finally, I applied a modern computational model of speech production, namely WEAVER++, to the repetition experiment of Donders. Computer simulations revealed that the difference in findings between Donders and his students may result from using different criteria for responding under the c-method. To conclude, unpublished data, a recent replication, and modern modeling shed new light on an issue that remained unresolved for more than 150 years.

Predictable words leave production-like traces in memory

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It has been hypothesized that the production system is also used during comprehension; specifically, comprehenders might generate predictions by covertly producing what they would say if they were the speaker (e.g., Chang, Dell, & Bock, 2006; Federmeier, 2007; Pickering & Garrod, 2007). The present study investigated whether predictable words leave production-like traces in memory. Two experiments capitalized on the production effect, which is the observation that words are remembered better when read aloud than when read silently (e.g., MacLeod et al., 2010). If reading predictable words involves covert production, the memory improvement from actually producing the words should be smaller for predictable words than for unpredictable words.

In Experiment 1, participants read sentence endings that were predictable ("He swept the floor with a broom") or unpredictable ("He noticed the man with the broom"). The final word was read aloud or read silently, depending on the color of the lead-in sentence (blue/red, counterbalanced). As expected, production improved recognition memory, but critically, there was an interaction such that the memory improvement from reading aloud was smaller for predictable words than for unpredictable words. This is consistent with the idea that reading predictable words can involve covert production.

Experiment 2 used the same procedure, but employed a source memory task in which participants identified which words they had read aloud and which ones they had read silently. If reading predictable words involves covert production, then for predictable words it should be relatively more difficult to remember whether they had been read aloud or silently. The results revealed a small reduction in aloud/silent discriminability for predictable words compared with unpredictable words, suggesting that predictability made it harder to tell the difference. In summary, predictable words seem to leave production-like traces in memory, which supports the hypothesized relationship between prediction and production.

Semantic and letter fluency performance in people with aphasia:

Analysis of additional performance measures

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Background and Aim: Semantic and letter fluency tasks are widely used in language assessments. They are well-established measures of lexical-semantic abilities in people with aphasia (PWA). However, it is known that both lexical retrieval and executive control abilities are involved to successfully perform these tasks. Typically, only the number of correctly generated words is used as a metric to quantify performance, which do not allow a differentiation between the different cognitive components involved. In this research, we implement analyses techniques (such as clustering, switching, and temporal measures) to explore the lexical and executive control contribution for verbal fluency performance in PWA. We compared PWA's performance with healthy control participants.

Method: We tested letter (d, n, h, s) and semantic fluency (sports, clothes, sweets, animals) as well as executive functions (shifting, working memory and inhibition) in nine PWA and nine age-, gender- and education-matched healthy controls. Following variables were derived from the data: number of correct response, number of switches, cluster size, word frequency and temporal response parameters (1st response time, initiation parameter, slope).

Results & Conclusion: PWA produced fewer words in both fluency tasks, but qualitative performance measures such as cluster size and word frequency did not differ between the groups. However, temporal parameters indicated that letter fluency tasks are more effortful for PWA in comparison to healthy controls. Both letter and semantic fluency were correlated more strongly with executive functions in PWA compared with healthy controls. Findings highlight the importance of using detailed characterization of verbal fluency data to better understand the basic underlying processes that enables successful performance.

The lexical nature of alpha-beta desynchronisation in context-driven word production

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Previous studies examining context-driven word production have shown that picture naming is faster following constraining than non-constraining sentential contexts (e.g., “The farmer milked the... [picture]” vs. “The child drew a... [picture]”, followed by the picture of a cow). In addition, desynchronization in the alpha and beta oscillatory bands (8-25 Hz) pre-picture onset has been consistently found for constraining relative to non-constraining contexts. However, it remains a matter of debate what the desynchronization is reflecting, e.g., low-level expectations of the visual input, conceptual and lexical retrieval, or motor preparation. The present study aimed at investigating the lexical-semantic nature of the alpha-beta desynchronization. Participants performed a context-driven picture naming task with constraining and non-constraining contexts. In addition, we presented an auditory distractor word before picture onset. Distractors were either semantically related (e.g., “goat”) or unrelated (e.g., “bean”) to the to-be-named picture, which created different amounts of lexical competition as a function of sentential context. Replicating previous findings, picture naming was faster with constraining than non-constraining contexts. The distractor manipulation did not affect this context effect, which is in line with the picture-word interference literature, where no effects of semantically related distractors are found at long stimulus-onset asynchronies (i.e., distractor presentation 1,000 ms prior to picture onset). Regarding the oscillatory brain responses, we observed the context related alpha-beta desynchronization pre-picture onset only when distractors were semantically unrelated to the picture. Thus, the alpha-beta desynchronization seems to be sensitive to the semantic relationship between the distractor and the lead-in sentence which creates a semantic context for the to-be-named picture. We interpret these results as suggesting that alpha-beta desynchronization in context-driven word production reflects lexical-semantic retrieval mechanisms.

Effects of visual perception on lexical selection and the role of shape details in object naming

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Research on spoken word production typically takes the activation of concepts as starting point and focuses on the lexical processing thereafter. In two experiments we investigated potential interface effects from visual to lexical processing by combining the semantic blocking paradigm with spatial frequency manipulations.

Exp. 1 provided evidence that the good-enough perception of to-be-named objects is significantly more cursory in homogeneous contexts and for visually variable categories (in contrast to visually consistent categories). We argue for a facilitated recognition in homogeneous contexts: they reduce the number of alternatives considered as possible targets. Thereby, perception of global shape information becomes sufficiently informative and the time-intensive detail perception can be dropped.

Exp. 2 tested whether contextual differences in stimulus perception affect naming speed and the numerously attested context effect. We presented pictures in standard conditions (allowing for a progressively more precise stimulus perception over multiple viewings (cycles)) and in contextually good-enough blurred conditions (not allowing for temporal dynamics in visual perception; perceivable shape details were reduced to a minimum). We found two distinct context effects.

In the first naming cycle homogeneous contexts shortened latencies with a larger positive effect in blurred conditions and for visually consistent categories. We argue that these results reflect the graded recognition advantage. In repetition cycles homogeneous contexts significantly hampered naming, with a larger negative effect in blurred and visually consistent conditions. We assume the context effect, detected as a systematically graded effect, to be due to a graded lexical competition which is (i) not only semantic but also shape-driven and (ii) dependent on both the available target-specific features and the total number of shared features.

To conclude, our experiments provide evidence that (cyclic) blocking paradigms affect both lexical and visual processing and, interestingly, the temporal dynamics in visual perception can apparently attenuate lexical competition.

Complexity matching in the sounds and words of Spanish and English conversations

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When people converse, multiple levels of speech and language representations have been found to converge. Recently, a new form of convergence called *complexity* matching was found in the nested clustering of acoustic events, and shown to reflect convergence of hierarchical temporal structure in lexical, phrasal, and prosodic units. Complexity matching predicts that convergence in hierarchical temporal structure should not require interlocutors to utter the same phonemes, words, or syntactic structures. Instead, convergence is expected to occur in the distributional properties of speech sounds over the relatively long timescales of intonation and prosody. Complexity matching is also more general, in that it predicts convergence of other power law distributions in speech and language. In the present study, we tested these predictions by examining convergence both within and across two different languages, expressed in two different measures of speech. Pairs of bilingual speakers conversed either in English or Spanish exclusively, or one spoke English while the other spoke Spanish (the Mixed condition). Results showed comparable amounts of convergence in hierarchical temporal structure in the Mixed condition compared with the Spanish and English language conditions. Convergence was also found in the frequency distributions of lemmas spoken in the Mixed condition. These results show that convergence in terms of complexity matching does not require a direct matching of linguistic tokens in conversation. Altogether, results provide evidence for complexity matching as a basic principle of both monolingual and bilingual language interaction.

Articulatory control and executive control in speech production

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Executive functions (EF) have been shown to be involved in various aspects of speech production, such as lexical selection. Whether the articulatory control aspect of speech production is associated with EFs is less clear (but cf. [1]). The present study investigates whether performance in speech tasks in which speakers quickly alternate between consecutive similar sounds (e.g., 'she sells sea shells') relates to executive control, particularly to cognitive shifting between alternatives.

To quantify articulatory control, we administered two maximum-performance speech measures in Dutch, involving fast and accurate repetition of 1) different tongue twister sentences, and 2) real-words and nonwords (as in diadochokinesis tasks). An index of participants' shifting ability was derived from their performance on a Letter Number cognitive shifting task. Indices of participants' selective attention ability and processing speed (baseline RT) were derived from their performance on a Flanker task.

Data from 69 healthy young Dutch adults were collected and analysed. Correlational-analysis results showed moderate positive correlations between speech tasks (maximum tongue-twister rate was correlated with maximum real-word and nonword rate, $r = .55$ and $r = .65$, respectively). Maximum word-repetition rate was negatively correlated with participants' baseline RT ($r = -.37$ and $r = -.31$, for words and non-words, respectively), but not with speakers' selective attention or shifting ability. Maximum tongue twister rate was not correlated with any of the three cognitive indices, but accuracy of tongue-twister production was negatively correlated with participants' baseline RT ($r = -.35$) and cognitive shifting cost ($r = -.34$).

Thus, the accuracy, but not maximum rate, with which speakers successfully alternate between consecutive similar speech sounds was associated with their cognitive shifting ability as quantified in our study. Our results thus extend the role of executive control in speech production to the 'late' speech production stages of articulatory control.

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Severe transitory language impairment after tumor resection preserved inner thinking processes and external-world comprehension: A single case observation

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Global aphasia is defined by a severe impairment in language production, repetition, and comprehension and is usually associated with damage to the left perisylvian language-related brain areas. Here we present a case of a 35 year-old woman, whose discrete brain tumor (WHO II) was located in the deep white matter of the left middle frontal gyrus (MFG). The patient presented global aphasia early after surgery for this lesion resection, but fully regained speech within the first 3 months of recovery. In the presurgical assessment, the patient scored within normal range in language and neuropsychological measures. Surgery was performed using brain mapping and until the end of the awake surgical phase, the patient was in verbal communication with the team. Unexpectedly, in the bedside assessment 5 days after surgery, the patient presented severe difficulties in language production, repetition, and comprehension. Structural neuroimaging revealed that in this acute, post-surgical phase, the white matter subjacent to the left MFG was lost with tumor resection. Additionally, vasogenic edema temporarily affected the pericavitarian areas. At 3 months post-surgery, edema was no longer present. At the same time, the patient successfully returned to a normal neuropsychological and language status. Importantly, she reported that during the acute stage she was able to formulate thoughts (confirmed by a score of 49 out of 52 in the Pyramids and Palm Trees Test 7 days post-surgery), but the production and comprehension deficit prevented her from any form of spoken communication. This uncommon case of transitory global aphasia shows the great potential of language functional recovery after surgery in the left MFG vicinity. Moreover, it suggests that a selective language impairment may be dissociated from thought and potentially from some form of inner speech. This finding adds new insights on the debate about the anatomo-functional separation of language production and thought.

The distractor lexicality effect in picture-word interference paradigm

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Our ability to avoid distraction by lexical stimuli while performing picture naming task could be affected by a range of psycholinguistic variables. For instance, in picture-word interference (PWI) paradigm pictures presented with high-frequency distractors are named faster than pictures presented with low-frequency distractors. In prominent theories of speech production the distractor frequency effect was interpreted as a consequence of high-level cognitive processes. In order to overcome distractor interference the control mechanism (selective attention, speech monitoring system) systematically suppresses irrelevant stimuli. It is easier to suppress high-frequency words in comparison with low-frequency words due to the greater activation of their lexical representations. Proposed explanation is suitable not only for the distractor frequency effect, but also for the distractor lexicality effect. The control mechanism must spend more time on suppressing pseudoword distractors in comparison with simple lexical distractors due to the difficulties in their recognition. This hypothesis was confirmed in two PWI experiments, where pseudoword stimuli were created by replacing single phonemes in high-frequency words (Experiment 1) or by selection of extremely low-frequency words unknown to the majority of participants (Experiment 2). Both experiments were conducted on the material of Russian language. The obtained results contradict findings of E. Dhooge and R.J. Hartsuiker (2012). In their experiments the distractor lexicality effect had an opposite direction. We explain the contradiction between experimental results by the fact that E. Dhooge and R.J. Hartsuiker generated pseudoword stimuli using the computer program «WordGen», while in our study pseudowords were made from the real words of Russian language. Thus, the method of pseudowords creation could be a critical determinant of the distractor lexicality effect in PWI paradigm.

Lexical and syntactic memory representations for sentence production:

Effects of lexicality and verb arguments

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Neuroimaging studies have shown that a core network of inferior frontal cortex and posterior temporal cortex with a left hemisphere dominance is involved in sentence comprehension as well as production. However, we know little about the production of sentences featuring verbs differing in argument structure. Here we tested whether brain activation patterns differed when participants were producing sentences which varied in the number of verb arguments (intransitive/transitive/ditransitive verbs). Furthermore, we assessed the effect of lexicality using existing Dutch verbs and pseudoverbs. This was done because processing parts of sentence structure, such as verb-arguments could be lexically-driven.

We obtained functional MR images while 30 right-handed native speakers of Dutch produced sentences cued by visual input. On each trial, participants first saw the (pseudo)verb to-be-used in the centre of the screen, followed by the three geometric shapes in a horizontal layout. Participants overtly produced a sentence with the same structure as the example presented at the beginning of each mini block, using the (pseudo)verb and the figures.

Overall, a verb lexicality effect (verb > pseudoverb sentences) was found in the left inferior frontal gyrus (LIFG) and the left posterior middle temporal gyrus (MTG). Additionally, a more posterior bilateral middle temporal region showed greater activation for this contrast. A verb argument effect (ditransitive > intransitive) was accompanied by an increase in activation in the left posterior MTG and bilateral precuneus. The left posterior MTG cluster overlapped substantially with the cluster found for the lexicality contrast.

We show that sentence production using existing words compared to pseudowords elicits greater activation in the core language network. The increased activation in the left posterior MTG for the verb argument effect is linked to the complexity of the syntactic options attached to the verb. These memory representations are used during production of the efficient construction of sentences.

Priming the metonymic expressions in sentence production

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A considerable number of psycholinguistic studies (e.g., Frisson & Pickering, 1999) have investigated how we 'comprehend' metonymic expressions (e.g., I bought Dickens instead of I bought Dickens's book). However, little is known about how we 'construct' them. The present study reports on an experiment that investigated how we construct such metonymic expressions in Japanese sentence production.

In a recall-based sentence production task (Ferreira, 2003), speakers encoded two sentences into memory, but were only prompted to produce one of those sentences. On Prime trials, speakers were presented with a Filler sentence and then the Prime sentence, and were asked to produce the Prime. On Target trials, speakers were presented with the Target sentence and then a Filler sentence, and were prompted to produce the Target. The form of speakers' subsequent Target was examined. There were three prime conditions: metonymic (I read dickens), non-metonymic (I read Dickens's book) or literal expressions (I met Dickens). Targets comprised a subject NP followed by an object with metonymic expression only (e.g., He bought Madonna), allowing a metonymic or a non-metonymic completion. In this type of task, people tend to recall the meaning of the sentence correctly but produce the form freely, reflecting the normal biases of language production (e.g., Ferreira, 2003).

Results (30 participants, 48 items) showed a reliable effect of Prime; speakers were more likely to recall the metonymic expressions correctly after recalling the metonymic expressions (98%) than after recalling the non-metonymic (86%) and literal expressions (92%, $p < .005$) as the Primes. In addition to this, the difference in the proportions of the non-metonymic and literal expressions was not statistically significant ($p > .05$). These results displayed a tendency for speakers to repeat the metonymic expressions, suggesting that speakers can access the metonymic expression directly. I discuss these findings in the context of theories of production.

Is the tendency to lexically entrain stable within individuals?

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Despite decades of research on lexical entrainment (e.g., Clark, 1996; Pickering and Garrod, 2004, Giles and Ogay, 2007), it is unknown whether speakers are consistent in their propensity to lexically entrain. Exploring this issue is important for both evaluating experimental manipulations and understanding individual differences, where it is crucial to ensure that lexical entrainment measures are stable.

We investigated whether speakers' tendency to lexically entrain is consistent across time and interlocutors. We conducted two experiments in which native speakers of British English engaged in two sessions of a picture–matching and –naming task. Participants alternated turns with an alleged player to select and name a target. Although participants believed they played with a different partner in each session, they played with a machine. Experimental items comprised a target that could be named with a favoured and a disfavoured label (*umbrella* vs *broolly*). (To determine the labels, the materials were pre-tested.) The machine always named the experimental targets before the participants, using the disfavoured name exclusively. Participants' use of the disfavoured word when naming the target was interpreted as lexical entrainment; their use of any other word was interpreted as non-entrainment. While in Exp 1 participants played both sessions immediately consecutively, in Exp 2 there was a week gap between sessions.

Participants entrained above chance in both Exp 1 ($V=1, p<.0001$) and Exp 2 ($V=1, p<.0001$). Participants' tendency to entrain during both sessions was highly correlated not only in Exp 1 ($r=.81, p<.0001, 95\% \text{ CI } [0.63, 0.91]$) but also in Exp 2 ($r=.71, p<.0001, 95\% \text{ CI } [0.44, 0.86]$). These results suggest that speakers' tendency to lexically entrain is stable across time and interlocutors, both validating results of previous experiments exploring the effects of transient factors and providing a solid basis for the study of individual differences.

Referential overspecification as a rational strategy

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Contra Grice's Maxim of Quantity (Grice 1975), recent studies indicate that speakers often overspecify their referring expressions (e.g., Koolen et al. 2011). We investigated whether overspecifications are driven by information-theoretic factors like entropy reduction: When the referential domain is sufficiently complex, speakers may include "redundant" information in order to help restrict the search space, reducing cognitive effort for themselves and/or the comprehender (Tourtouri et al. 2017). In a referential communication task, we manipulated the Necessary Adjective (whether colour or pattern was required to uniquely specify the target) and the Entropy Reduction Advantage of each adjective (whether colour or pattern reduced entropy more, or equally), and measured the rate of overspecification per condition. If referential entropy influences speakers' choices, then more overspecifications should be found when a redundant adjective reduces referential entropy more, relative to conditions in which the necessary adjective reduces entropy more or when both adjectives reduce entropy equally. Based on their use of overspecification, we identified three groups of speakers. A first group (N=11) used a redundant adjective more often when it reduced referential entropy more than the necessary adjective, supporting the above predictions and suggesting that speakers may use overspecification rationally. A second group (N=10) used a redundant colour attribute more than 80% of the time, exhibiting a low-cost strategy for both the speaker and the listener, as colour is frequent language-wide, and it is a salient property that can guide visual search and ease target identification. Finally, a third group (N=14) used both colour and pattern adjectives more than 80% of the time, possibly minimising speaker effort. These results highlight individual differences in language production, and indicate that speakers' choice to overspecify may be driven by different factors that can vary from egocentric to rational considerations.

Code-switching patterns en un modelo computacional: Simulating code-switching in a bilingual sentence-production model.

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People who speak several languages are able to switch from one to the other, a process called code-switching, between or even within sentences. The underlying mechanisms, however, are still not well understood; using computational modeling one can simulate code-switching behavior in multilinguals with the goal to explain the process. Hence, we have extended Dual-path (Chang, 2002), a connectionist model of sentence production, to handle two or more languages (Tsoukala et al., 2017). The Dual-path model is trained on message-sentence pairs and it learns to produce a sentence, word by word, given its semantic representation.

Using the Dual-path model we have simulated sentence production in early Spanish-English bilinguals and late speakers of English who have Spanish as a native language. The difference between the models is that the early bilingual one is exposed simultaneously to Spanish and English, whereas the latter learns to produce Spanish sentences before getting exposed to English. We then manipulated language control to allow the model to produce sentences in either language or to code-switch. Interestingly, the model was able to produce code-switches even when it was not exposed to code-switched input.

The model predicts how code-switching patterns differ between early and late bilinguals. The early model code-switches much more frequently: 17% of sentences contained a code-switch as opposed to 1% in the case of the late model. Furthermore, most code-switches in the early models were complex mid-sentence switches (alternational code-switches; 7.5% as opposed to 0.34%), whereas the late models mainly inserted nouns from their L1 Spanish when producing English. Empirical works have not focused yet on a comparison between code-switched production of early and late bilinguals, but the results are in line with Poplack's (1980) findings; in the Puerto-Rican community in the US, balanced bilinguals produced complex code-switches, whereas Spanish-dominant bilinguals inserted tags and nouns.

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Talking about temporal events: What oral production tells us about time conceptualization

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Metaphor research has distinguished two complementary patterns used to conceptualize time by means of space (e.g., Clark 1973; Lakoff & Johnson 1980, 1999). In Ego-moving metaphors, the Speaker/conceptualizer metaphorically “moves” through time, e.g., approaching a future event, which is construed as an immobile landmark. Alternatively, in Time-Moving metaphors, it is the Temporal event what is conceptualized as a moving “Figure” while the Speaker acts in this case as an immobile landmark. A great deal of research in psycholinguistics has used these two metaphors as a testing ground for the psychological reality of conceptual metaphors (e.g. Boroditsky and Ramscar 2002; Gentner, Imai & Boroditsky, 2002; see also McGlone and Pfiester (2009) for the role of emotion in the choice of these patterns).

What is missing in all these studies is a thorough examination of the lexical choices used by speakers in real-world situations. The present study analyzes a large oral corpus, the NewsScape Library of TV News, developed by the Red Hen Lab, an international research consortium, which contains over 3 billion words formed by the transcripts of the utterances of speakers in TV shows. Using the search tools of the CQPWeb Corpus Query Processor (Uhrig, 2017), our results have found that the production of speakers when talking about temporal event encompasses a much richer lexical variety than the one reported in the literature so far, with almost 50 different verbs of motion used with these metaphors. These verbs often include rich details about the motion event (e.g., its path or its manner), whose role in the conceptualization of the temporal event has not been explored so far. This work examines how these production patterns can help us attain a clearer image of the conceptualization patterns at work in the mind of speakers when reporting temporal events in real-life situations.

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**Investigating semantic context effects on language production with a combined
eye tracking and picture naming paradigm**

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Word production has been shown to be highly dependent on context and task requirements, which can either inhibit or facilitate this process (Abdel Rahman & Melinger, 2009, Navarrete et al, 2012). Using a novel, combined eye tracking and picture naming paradigm the study aims to assess how speakers perceive a given semantic context and how they use this context to select the appropriate linguistic denotation for real world objects.

The participants' (30 German native speakers) eye movements are tracked while viewing a set of eight words, of which a minimum of three belong to the same semantic category. They then have to name a picture that is either related or unrelated to the word set. We analyze the effects of semantic relation and of the number of related items shown in the context set on word production speed and accuracy. In addition, using eye tracking we explore the relationship between naming latencies and pre-verbal cognitive processing of the semantic relations between the word stimuli. We expect increased fixation durations on related vs. unrelated items and increased naming latencies proportional to the number of related items in the context set, and to the amount of time participants fixate on these words relative to unrelated words. The study therefore provides a relevant extension to the current research on semantic context effects, as it investigates how the size and processing intensity of a given semantic context are causally related to word production. Data collection is in process and will be finished by mid May 2018. In further experiments the paradigm will be implemented in a clinical population with aphasia after stroke.

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Verbal fluency and working memory interaction

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Focus of this study was to review which aspects of working memory, and to what extent, are associated with verbal fluency. It is generally believed that working memory consists of the phonological loop, the visuospatial sketchpad and the central executive. The aim of this study was to examine the interaction of the visuospatial sketchpad and central executive with semantic and phonemic fluency. Our research hypotheses were (1) there will be a positive correlation between the visuospatial sketchpad and semantic fluency, (2) the correlation effect sizes will differ depending on semantic category and (3) there will be a positive correlation between the central executive and both fluency tasks. The visuospatial sketchpad was assessed with the Spatial Working Memory test, and the central executive with the Attention Switching Task (both tests are part of the CANTAB test battery). The study included 20 participants, ranging from 18 to 30 years of age. According to Levelt et al. (1999) lexical access is the ability to retrieve grammatical representations and sound forms of words from the mental lexicon, and the executive control ability controls and regulates thought and direct behavior toward a general goal. Furthermore, in performing the semantic fluency task, a validated tool for lexical access assessment, participants rely on existing links between concepts or words in word retrieval (e.g., cat) and can automatically activate semantically associated words (e.g., dog, tiger), while in performing the phonemic fluency task such associations need to be inhibited. In accordance with Levelt's model, the results of this study suggest that the central executive functions may play a great role in the performance of both fluency tasks, and that the visuospatial component has an important role only in semantic fluency. Therefore, differences in the two fluencies likely depend on different mechanisms of the mental lexicon.

Evidence for modification of the cumulative semantic interference effect when the names for pictures have previously been retrieved from definitions

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The cumulative semantic interference (CSI) effect refers to the increasingly longer naming times that are found when several pictures from the same category are presented. We report an experiment which investigates whether or not the CSI effect is modified for pictures whose names have been retrieved beforehand from definitions. Wheeldon and Monsell (1992) presented data consistent with definition repetition priming effects occurring as a result of strengthened connections between semantic and lexical representations. Strengthened connections are relevant to two accounts of the picture naming CSI effect (Howard, Nickels, Coltheart & Cole-Virtue, 2006; Oppenheim, Dell & Schwarz, 2010). Here, we constructed definitions using semantic feature norms. We reasoned that, if semantic features are activated during picture naming (Oppenheim et al.), the inclusion of unique features in the definitions should reduce the subsequent picture naming CSI effect.

Pictures from 16 different semantic categories were presented, with 5 pictures for each category (i.e. 5 ordinal positions within category). Category pictures were separated by 2 unrelated filler pictures. In a first block, participants retrieved the names of pictures from definitions, for half of the semantic categories. In the second block, the participants named all the experimental (primed and unprimed) and filler pictures. Initial results indicate that participants were more accurate when naming primed pictures than unprimed pictures. For naming times, the CSI effect was replicated for the unprimed pictures, but there was no increase in naming times across ordinal position for the primed pictures. The results will be discussed in relation to connectionist accounts of the CSI effect, and the more recent temporary bias account offered by Roelofs (2018).

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Spatial cues influence lexical-semantic processing

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In the present study we explored whether task-irrelevant spatial information in sentence contexts influence lexical selection. German sentence fragments (N=90; e.g.: „Du / spazierst / durch / den / Park / und / entdeckst / einen / ...“ („You are strolling through the park and you are spotting a ...“)) were presented word by word either in ascending order from the centre to the top of the screen or in descending order from the centre to the bottom, and participants were asked to find a suitable ending by producing a noun (e.g., bird). All sentence completions were rated by three independent raters on a 9-point-Likert-scale whether the named objects are typically found in upper or lower space in real life (e.g., bird vs. ant). Preliminary data suggest that participants are more likely to name a noun associated with the upper space when the sentences were presented in an ascending mode compared to the same sentences presented in descending mode, and vice versa. We suggest that the presentation mode triggers simulation processes which in turn bias lexical-semantic processing. This influence on the selection of words by visual simulation points to a role of experiential traces during early stages of speech planning. Future research should further investigate this proposed interplay between lexical selection and embodied accounts of meaning to elucidate when and how non-semantic aspects of meaning influence the process of lexical selection.

Separating the effects of segment repetition and segment predictability:

A masked onset effect in the Mandarin form-preparation task

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In the form-preparation paradigm, an onset-preparation effect on spoken word production, typically found in Germanic languages, has been absent in Chinese and Japanese. To investigate the underlying mechanism, the effects of segment repetition and segment predictability on Mandarin spoken word production were examined separately. Native Mandarin speakers named pictures in the following conditions: predictable, unpredictable, and no segment repetition. Different positions in words (i.e., the onset and the rhyme) were examined at the same time. Results revealed a facilitative effect of onset predictability masked by an inhibitory effect of onset repetition between consecutive picture names, indicating Mandarin speakers' ability to prepare the predictable onset. In contrast, the effect of rhyme predictability was not significant, suggesting that segments, probably as subordinate phonological units, are encoded serially in Mandarin spoken word production. Our finding provides crucial constraints in developing models of Chinese spoken word production.

Time course of syllabic and sub-syllabic encoding in spoken word production:

Evidence from Cantonese Chinese

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Two experiments were conducted to investigate the time course of syllabic and sub-syllabic processing in Cantonese spoken word production by using the picture-word interference task. Cantonese-speaking participants were asked to name individually presented pictures aloud and ignore an auditory word distractor. The targets and distractors were either phonologically related (i.e., sharing two identical word-initial phonemes) or unrelated. In Experiment 1, the target syllables were all consonant-vowel(CV)-structured. The phonological distractor was either a CV syllable (i.e., Full Syllable Overlap) or a CVC (consonant-vowel-consonant) syllable (i.e., Sub-syllable Overlap). Relative to the unrelated control, Full Syllable Overlap distractors facilitated naming in all stimuli onset asynchronies (SOAs) (-175, 0, or +175 ms) whereas Sub-syllable Overlap distractors exhibited facilitation only at 0-ms and +175-ms SOAs. Experiment 2 adopted a similar design to examine the possible influence of syllabic structure similarity on the results of Experiment 1. The target syllables were all CVC-structured. The phonological distractor was either a CVC (i.e., Syllable-structure Consistent) or CV (i.e., Syllable-structure Inconsistent) syllable. Comparable priming was observed between the two distractor conditions across the three SOAs. These results indicated that an earlier priming effect was observed with full syllable overlap than sub-syllabic overlap when the degree of segmental overlap was held constant (Experiment 1). The earlier syllable priming observed in Experiment 1 could not be attributed to the effect of syllabic-structure (Experiment 2), thereby suggesting that the syllable unit is important in Cantonese and is retrieved earlier than sub-syllabic components during phonological encoding.

Syntactic encoding in the face of context

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In two picture description experiments with German native speakers, we manipulated the discourse status of the agent and patient in transitive scenes by adding a mini lead-in discourse before Ss were to produce the target responses (Prat-Sala & Branigan 2000), as well as the sequence of participant's visual attention directed to the event referents by means of an attention capture technique (Gleitman et al. 2007). Patients were visually cued in Experiment 1 and agents were cued in Experiment 2. Our aim was to determine (1) whether the discourse status of the referents as a factor for syntactic choices outranks thematic role information and visual salience, and (2) how the contextual information would be mapped from the conceptual representation to linear positions in the sentence structure? Eye movements were recorded.

In both Experiments, Ss' visual attention was drawn to the cued entity in more than 79% of all trials when this entity carried topic status, whereas the proportion dropped to 37% when the cued entity was not topical. Thus, the effectiveness of visual cueing is modulated by the discourse status of the cued entity. With respect to syntactic choices, we found that topical referents, regardless of their thematic roles, always appeared in the sentence-initial position (only active and passive structures were observed). Moreover, we found that producing an active sentence (with agent as topic) was significantly faster than producing a passive sentence (with patient as topic). Taken together: information structure specifications influence sentence production from early on by directing processing attention to topical entities, they outrank thematic role information, as well as visual salience of referents, and they are mapped onto the semantic level before grammatical encoding (function assignment/linearization) begins.

Task effects in prosodic planning

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Speakers planning an utterance know something about the later parts of an utterance when they begin to speak, leading to proposals that they generate a structured planning framework for the utterance (Garrett 1975; Shattuck-Hufnagel 1979, 1992), and that this framework is prosodic (Keating and Shattuck-Hufnagel 2002). Levelt and colleagues proposed the Prosodic Word (PWd) as the articulatory encoding unit, and Wheeldon and Lahiri (1997) tested this hypothesis by measuring initiation time (RT) and sentence duration in two speaking tasks in Dutch. In Task 1, speakers pre-prepared an utterance to produce at a signal; RT reflected the number of PWds in the utterance, but not the number of lexical words or syllables. In Task 2, speakers generated an online spoken response to a question about a visual display; RT reflected the complexity of the initial PWd only. These findings support the hypothesis that the PWd plays a role in representations that govern planning, but that the domain of planning may vary with the degree of pre-planning for the task. The present study tests a third speaking task: immediate reading aloud.

Eight (5F, 3M) Australian English-speaking adults (Mean: 34;3 yrs) heard 54 stimuli, varying in sentence type (control: I drink wine vs. clitic: I drink the wine vs. non-clitic: I drink John's wine), randomized and presented in DmDx; participants read the sentence text aloud as quickly as possible after it appeared. Productions were audio-recorded in Audacity and 1256 sentences analysed in R. Results revealed significantly faster RT for control than non-clitic sentences ($p < .0001^*$), as well as for clitic compared to non-clitic sentences ($p = .0004^*$). These findings suggest that, in reading aloud, planning is governed by the number of PWds, not the complexity of the initial PWd. This suggests that different speech production tasks may invoke different planning mechanisms.

Dissociating explicit memory from implicit learning in structural priming

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Structural priming refers to the tendency for speakers to repeat previously experienced sentence structures. Much research posits a multifactorial account by which an implicit learning process and an explicit memory related process jointly contribute to structural priming. One way to test this hybrid account is to dissociate the facilitation effect of lexical repetition on structural priming (i.e., lexical boost), which was argued to be an explicit memory effect, from the abstract priming effect, which is arguably driven by implicit learning. The current study furthers this argument by examining the effect of structural priming and lexical boost over memory-load interference between prime and target. In two pairs of experiments, participants were either paired with a scripted confederate to take turns to complete picture description task and arithmetic problem solving task (priming experiment) or performed in a corresponding memory experiment. Dutch s-genitive (e.g., *De jongen zijn eend is rood* [The boy his duck is red]) and of-genitive (e.g., *De eend van de jongen is rood* [The duck of the boy is red]) were employed as the prime structures. The lexical overlap between prime and target as well as the difficulty of the interfering tasks were manipulated. In both priming experiments, the effect of structural priming and lexical boost were found, which corresponded to the same pattern in the memory experiments. The likelihood of s-genitive production in both priming experiments negatively correlated with the critical trial number, which can be taken as evidence of implicit learning. We found that the difficulty of the interfering task modulated the effect of structural priming, indicating a memory-load effect on explicit memory of sentence structure. However, such effect did not interact with lexical overlap. Taken together, the findings substantiated that explicit memory and implicit learning jointly affect abstract and lexicalized structural priming.

The development of lexical planning scope and its impact on speech fluency

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The scope of lexical planning, which means how far ahead speakers plan lexically before they start producing an utterance, is an important issue for research into speech production, and highly correlated with speech fluency. However, it remains unclear how speakers develop to use an appropriate planning scope to reach fluent speech. To shed light on this issue, the present research took the semantic interference effect of the picture-word interference paradigm as an index to examine the lexical planning scope of three age levels coming from colleges, middle schools, and primary schools respectively. Participants produced utterances of the form “The snail and the necklace are above/below/on the left/right side of the toothbrush” for objects containing these referents (e.g., a snail, a necklace & a toothbrush), and each display was accompanied by a visual distractor which was categorically related or unrelated to the target object on which it was presented, and was always unrelated to the other objects. For both the undergraduate students (aged in 18~23 yr) and the middle school students (aged in 13~14 yr), there was a semantic interference effect for the first noun, showing longer latencies in categorically related conditions compared to unrelated conditions. For the primary school students (aged in 9~10 yr), the semantic interference effect for the first noun was observed in the error rates rather than the onset latencies. In addition, the primary school students made much more errors than the other two groups, while there was no difference in errors between undergraduate students and middle school students. These results indicate that the speakers aged in 13~14 yr have adopted a radically incremental pattern for lexical planning to reach fluent speech. The speakers aged in 9~10 yr have not completed the lexical selection for the first noun before speech onset, resulting in the disfluent speech.

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Monitoring language selection errors in switching: Not all about conflict

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Although bilingual speakers are very good at selectively using one language rather than another, sometimes language selection errors occur. To investigate how bilinguals monitor their speech errors and control their languages in use, we recorded event-related potentials (ERPs) in unbalanced Dutch-English bilinguals in a speeded version of the cued language-switching task. We tested the conflict-based monitoring model (Nozari, Dell, & Schwartz, 2011) by investigating the error-related negativity (ERN) and comparing the effects of the two switching directions (i.e., to the first language (L1) vs. to the second language (L2)). Results show that the speakers made more language selection errors when switching from their L2 to the L1 than vice versa. In the EEG we observed a robust ERN effect following the language selection errors compared to correct responses, reflecting monitoring of speech errors. Most interestingly, the ERN effect was enlarged when the speakers were switching to their L2 compared to switches to the L1. Our findings do not support the conflict-based monitoring model.

**Discriminating conceptualization vs formulation influence on referential choices:
Evidence from similarity-based interference effects in Mandarin Chinese**

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Semantic similarity between entities can cause interference in production (similarity-based interference effects (SIE)). Some studies show that semantic similarity leads to *more* explicit referring expressions, e.g. a full NP (Fukumura et al., 2011), whereas other studies show it leads to *less* explicit referring expressions, e.g. omission (Hsiao et al., 2014). We propose that this contradiction may reflect the conceptualization vs formulation stages in production (Levelt 1989). We conducted two experiments investigating SIE on referential choices in Mandarin Chinese. We manipulated semantic similarity between the *target* and the *competitor* (*high-similarity vs low-similarity*). We measured the use of omission, pronoun and repeated NP.

In Exp 1, participants saw introductory pictures and preambles mentioning both target and competitor, then described actions involving only the target. Participants produced fewer omissions ($p < .001$) and more repeated NPs ($p < .001$) in the high-similarity than in the low-similarity condition. In Exp 2, we increased retrieval difficulty for the competitor. Participants saw introductory pictures and preambles mentioning only the target, but described actions involving *both* the target and competitor. Participants produced more omissions ($p < .001$) and fewer pronouns ($p < .001$) in the high-similarity than in the low-similarity condition.

We found different SIE consequences under different production conditions. When only targets are mentioned, Mandarin speakers use *more* explicit referring expressions, which could be due to an extra need to single out the concepts of the target from the competitor at the conceptualization stage. When confronted with a greater retrieval load for one entity, Mandarin speakers use *less* explicit referring expressions, which may reflect a strategy to mitigate the increased retrieval load and maximize production efficiency at the later formulations stage. Thus, our study discriminates conceptualization vs formulation influence on referential choices.