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Centre Universitaire Paris Descartes,
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### Friday, September, 2nd  
**13:00-15:00 Poster Session II**

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Constraints on complex center-embedding: grammar or processing?
Markus Bader
University of Konstanz
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Corpus studies of multiple center-embedding are rare despite its importance within syntactic theory and psycholinguistics. In the most comprehensive corpus study, Karlsson (2007) analyzed 132 doubly center-embedded clauses from seven European languages, postulating several (quasi-)grammatical constraints specifically tailored to the needs of multiple center-embedded clauses.

Based on the deWaC corpus (Baroni, Bernardini, Ferraresi & Zanchetta, 2009), this poster presents a corpus study of multiply center-embedded relative clauses (RCs) in German which goes beyond Karlsson (2007) not only by looking at a larger number of examples but also by taking into account close variants involving extraposition. This makes it possible for the first time to determine empirically whether multiply center-embedded RCs have unique properties requiring specific grammatical constraints.

Sentence (1) is an original corpus example with a doubly center-embedded RC. In (2), RC-high is center-embedded but RC-low has been extraposed. In (3), RC-high has been extraposed but RC-low is center-embedded. In (4) finally, RC-high and RC-low have both been extraposed. A search of the deWaC corpus (1,278,177,539 tokens of text) revealed 343 instances of doubly center-embedded RCs as in (1). In accordance with Karlsson (2007), sentences with more deeply embedded RCs were practically absent.

(1) **RC-high center-embedded, RC-low center-embedded**
    Probleme gab es, weil einige Kurse,
    *die in der schönen Broschüre, die man vorher zugeschickt bekommen, aufgelistet waren*,
    that in the nice brochure that one before sent got listed were
gestrichen worden waren.
    cancelled been were
    ‘There were problems because some courses which were listed in the nice brochure which was sent out in advance were canceled.’

(2) **RC-high center-embedded, RC-low extraposed**
    Probleme gab es, weil einige Kurse,
    *die in der schönen Broschüre aufgelistet waren, die man vorher zugeschickt bekommen* gestrichen worden waren.

(3) **RC-high extraposed, RC-low center-embedded**
    Probleme gab es, weil einige Kurse gestrichen worden waren.
    *die in der schönen Broschüre, die man vorher zugeschickt bekommen, aufgelistet waren*,

(4) **RC-high extraposed, RC-low extraposed**
    Probleme gab es, weil einige Kurse gestrichen worden waren.
    *die in der schönen Broschüre aufgelistet waren, die man vorher zugeschickt bekommen*

Thus, doubly center-embedded RCs do occur, but they are rare. This raises two major questions:
(i) Why are doubly center-embedded RCs not avoided completely by means of extraposition? A logistic-regression model confirms the null-hypothesis that the same factors are at work as
in extraposition of simple RCs (e.g., Hawkins, 1994): rate of extraposition ((1) versus (3)) can be predicted with high accuracy (Somer’s C about 0.93) from the amount of material crossed by extraposition.

(ii) Why do doubly center-embedded RCs occur so rarely? The null-hypothesis is that the lengthy dependency between the antecedent NP and the clause-final verb makes complex intraposod relative clauses difficult to process (e.g., Gibson, 2000), and not center-embedding as such. The null-hypothesis is confirmed again. In intraposed position, sentences with degree of center-embedding = 1 occurred about five times as often as sentences with degree of center-embedding = 2 ((2) versus (1)). Importantly, a similar ratio turned up in extraposed position (sentences with degree of center-embedding = 0 (cf. (4)) versus sentences with degree of center-embedding = 1 (cf. (3)).

The present results argue that constraints on multiple center-embedding follow completely from processing limitations; grammatical constraints are superfluous. This conclusion is confirmed by two further pieces of evidence. First, 15% of all corpus instances of type (4) had the VP of RC-high missing. Thus, memory limitations causing the missing-VP effect (e.g., Gibson & Thomas, 1999) also apply to language production. Second, a grammaticality-judgments experiment investigating the structures in (1)–(4) and sentences with the VP of RC-high missing showed that such structure are perceived as basically grammatical and that the missing VP effect also occurs in language comprehension (see Table 1).

Table 1: Mean percentages of grammatical judgments. Standard error (by participants) is given in parentheses.

<table>
<thead>
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<th>RC-low center embedded</th>
<th>RC-low extraposed</th>
<th>Missing VP</th>
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<tr>
<td>RC-high extraposed</td>
<td>85 (2.7)</td>
<td>83 (4.0)</td>
<td>13 (3.9)</td>
</tr>
<tr>
<td>RC-high center-embedded</td>
<td>77 (4.4)</td>
<td>73 (4.1)</td>
<td>58 (4.8)</td>
</tr>
</tbody>
</table>

References:


Representing Syntax: 
Priming various syntactic representations

Nick Gruberg and Victor Ferreira
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The psychological representations of syntactic structure are, according to one view, hierarchical arrangements of constituent elements. According to a different view, they are idiosyncratic pairings of sentence forms with the semantic meanings they convey (e.g. constructions). Most evidence from syntactic priming studies is consistent with both views, because variation in semantic roles is usually conflated with variation in constituent structure. But evidence from two priming studies provides selective support for each theory. Bock and Loebell (1990) show that the constituent structure of a prime sentence can influence syntactic choice independent of semantic roles, supporting constituent structure accounts. Chang et al. (2003) show that differences in the order of semantic roles can influence syntactic choice independent of constituent structure, supporting constructionist accounts.

The aims of this study are, first, to compare these priming mechanisms individually and in combination, and, second, to determine whether both priming effects can be reduced to lexical priming of the preposition, which varies regularly between syntactic alternates. Accordingly, we created a novel set of picture stimuli depicting spray-load actions, whose alternate forms vary in terms of their semantic roles, but not their constituent structure. In the first of three priming conditions, we used spray-load prime-target pairs. In a second condition, we used dative prime-target pairs, whose alternate forms vary in terms of both semantic roles and constituent structure. And in a third condition, spray-load target descriptions were primed with embedded-NP sentences, which were structurally dissimilar but shared a preposition with one (or the other) of the spray-load alternates. Although some evidence suggests that closed-class content has no effect on syntactic choice (Bock 1989), no study has tested its effect in the absence of structural overlap between prime and target.

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<th>Prime Condition</th>
<th>Prime Sentence</th>
<th>Target Description</th>
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<td>Spray-Load</td>
<td>The woman, sprayed, the car, with water,</td>
<td>Santa stuffed the stockings with gifts</td>
</tr>
<tr>
<td></td>
<td>NP₁, V₂, NP₃, PP₄</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The woman, sprayed, water, on the car,</td>
<td>Santa stuffed gifts in the stockings</td>
</tr>
<tr>
<td></td>
<td>NP₁, V₂, NP₃, PP₄</td>
<td></td>
</tr>
<tr>
<td>Dative</td>
<td>The man, gave, a gift, to the secretary,</td>
<td>The boy tossed a ball to his friend</td>
</tr>
<tr>
<td></td>
<td>NP₁, V₂, NP₃, PP₄</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The man, gave, the secretary, a gift,</td>
<td>The boy tossed his friend a ball</td>
</tr>
<tr>
<td></td>
<td>NP₁, V₂, NP₃, NP₄</td>
<td></td>
</tr>
<tr>
<td>Embedded NP</td>
<td>The man, sprayed, the car with the dirty wheels,</td>
<td>Santa stuffed the stockings with gifts</td>
</tr>
<tr>
<td></td>
<td>NP₁, V₂, NP₃, PP₄</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The man, sprayed, the dirty wheels on the car,</td>
<td>Santa stuffed gifts in the stockings</td>
</tr>
<tr>
<td></td>
<td>NP₁, V₂, NP₄, NP₅</td>
<td></td>
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</tbody>
</table>

In Experiment 1, subjects heard a prime sentence, then were asked a question about it, and then described a target picture using the same verb as in the prime sentence. We measured how often subjects described the target picture using the same form they heard in the prime sentence. Spray-load prime-target pairs yielded a 22.9% priming effect. Dative prime-target pairs yielded a
23.2% priming effect. Embedded-NP sentences yielded a smaller 8.6% priming effect. All effects were significant.

In Experiment 2, the verb was not repeated between prime and target sentences. Here the dative prime-target pairs yielded a 3.8% priming effect (p=.08); the spray-load prime-target pairs yielded a 4.1% priming effect (p=.06); and the embedded-NP sentences yielded a -.07% priming effect. A follow-up study is planned to retest these effects with more power, but for now our conclusions will be limited to cases of priming with repeated verb.

We know a number of factors can affect syntactic choice during sentence production, (animacy, availability, discourse factors, heavy-NP shift, focal stress, argument-NP priming, etc.), including the syntactic character of the previous utterance (syntactic priming). Our results suggest that this ‘syntactic character’ can be defined in various ways, however its total effect on the syntax of the target utterance may be limited (to ~23% in this experiment). Thus we see the same prime effect for constituent structure and semantic role order in combination (as in dative prime-targets), as for semantic role order alone (as in spray-load prime-targets). Additionally, while the prime effect of the preposition does not reach the upper limit of syntactic priming, and prepositions may be a somewhat weaker indicator of syntactic structure in general, our results suggest that they may nonetheless have some effect on syntactic choice in the absence of stronger syntactic determinants. Thus syntactic production/priming may be more flexible than previously thought, drawing on input from various sources depending on sentence type.

References:
Structural Priming in Dutch Adverb-Object Ordering
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Background There is a vast amount of evidence for the existence of structural priming in both language production and comprehension (see Pickering and Ferreira 2008, Branigan 2007, Tooley and Traxler 2010 for overviews). Much attention within the literature has been devoted to constructional alternations involving verbal arguments, in particular active/passive and dative alternations. In this paper we want to extend the database of structural priming by considering alternations involving an argument and an adjunct (cf. Konopka and Bock 2009).

Empirical domain We investigate comprehension priming effects in Dutch scrambling constructions. In Dutch, direct objects are allowed to the left or to the right of an adverb in the midfield (cf. examples (1) and (2)). In addition, we investigate the presence of a 'lexical boost' effect relative to the adverb.

(1) De man zegt dat hij het boek gisteren gelezen heeft. [scrambled]
the man says that he the book yesterday read has

(2) De man zegt dat hij gisteren het boek gelezen heeft. [unscrambled]
the man says that he yesterday the book read has

Experiment We recorded the reading times of forty Dutch adults in a self-paced-reading task with a phrase-by-phrase moving window. Reading times were measured for 6 different regions in sentences with the structure in (3):

(3) Main Clause Subject Object Adverb Verb PP
Jan zei dat hij het boek gisteren gelezen heeft in de bus
'John said that' 'he' 'the book' 'yesterday' 'read has' 'on the bus'

Each participant read 50 target sentences as in (3) above with definite objects and adverbs of time (25 scrambled/25 unscrambled). These sentences were divided over 5 conditions following a Latin square design: (1) prime with same construction (scrambled or unscrambled depending on target sentence) and same adverb, (2) prime with same construction but different adverb, (3) prime with different construction (scrambled for unscrambled targets and unscrambled for scrambled targets) but same adverb, (4) prime with different construction and different adverb or (5) a baseline condition in which the target was preceded by a structurally unrelated filler item. A total of 157 fillers were added to the experiment.

Results We concentrate on the reading times in the VERB region (Table (1)). No differences were observed in the Object and Adverb regions.

<table>
<thead>
<tr>
<th>Target</th>
<th>Baseline</th>
<th>Same structure/ same adverb</th>
<th>Same structure/ different adverb</th>
<th>Different structure/ same adverb</th>
<th>Different structure/ different adverb</th>
</tr>
</thead>
<tbody>
<tr>
<td>scrambled</td>
<td>648 (31)</td>
<td>595 (30)</td>
<td>591 (26)</td>
<td>612 (25)</td>
<td>610 (30)</td>
</tr>
<tr>
<td>unscrambled</td>
<td>600 (29)</td>
<td>618 (29)</td>
<td>670 (34)</td>
<td>592 (28)</td>
<td>585 (26)</td>
</tr>
</tbody>
</table>

Table 1: Mean reading times (SE) in ms in the VERB region averaged over participants.

We performed a linear mixed-effect analysis with random effects for participants and items on the log-transformed reading times. The analysis showed no main effects for target type or
condition, but did show a significant interaction ($X^2(4)$: 15.3, p: .004). Table 2 shows the
direction and significance of the estimates of the interaction model with the baseline condition
as the intercept.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Scrambled targets</th>
<th>Unscrambled targets</th>
</tr>
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<tbody>
<tr>
<td>Same structure/same adverb</td>
<td>- .017</td>
<td>+ .665</td>
</tr>
<tr>
<td>Same structure/different adverb</td>
<td>- .017</td>
<td>+ .046</td>
</tr>
<tr>
<td>Different structure/same adverb</td>
<td>- .343</td>
<td>- .307</td>
</tr>
<tr>
<td>Different structure/different adverb</td>
<td>- .027</td>
<td>- .180</td>
</tr>
</tbody>
</table>

Table 2: Direction ('-' = faster, '+' = slower) and significance of estimates from the linear
mixed-effect model per condition in comparison to a baseline condition intercept.

The data show a different behavior of unscrambled targets in comparison to scrambled ones.
Unscrambled targets show prolonged reading times when preceded by a prime with the same
structure but a different adverb (a negative 'lexical boost'). Scrambled targets show a robust
priming effect in case of shared structure which is independent of repetition of the adverb.
When the structure of prime and target differ, only a difference in adverb results in priming.

Discussion The results provide initial evidence for structural priming in Dutch scrambling
constructions. They also point to a difference between scrambled and unscrambled
constructions. A difference between these constructions is also found in spoken language (cf.
van Bergen and de Swart 2010). Even though unscrambled constructions are more frequent in
spoken language, subordinate sentences in which the object directly follows the subject
(including both scrambled constructions as in (3)) are even more frequent. Hence, a reader
may anticipate a direct object when it encounters the subject (de Hoop and Lamers 2006 for
Dutch). This gives the intervening adverb in unscrambled sentences a more prominent status.
The reading of an unscrambled prime may increase the expectation of an adverb, which is
only partially fulfilled in a same-structure target with a different adverb, resulting in longer
reading times. Likewise, the reading of a scrambled prime speeds up the reading of scrambled
targets as it confirms the expected pattern.

Such an expectation-based view can, however, not account for the non-consistent
influence of the adverb on the reading times. It seems that the lexical boost effect with
adverbs is much more variable than with verbs. This is potentially due to the fact that adverbs,
in contrast to verbs, are more loosely connected to the sentence (meaning). This, however,
awaits further research.

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How do children represent syntactic structures? Syntactic priming effects – the unconscious repetition of syntactic structures between utterances and speakers – yield powerful evidence that adults retrieve abstract representations of syntactic relations during language production and comprehension [see 1, 2 for reviews]. Accordingly, syntactic priming has been used as a tool for examining children’s developing syntactic representations. Previous studies suggest that by three to four years, children have acquired abstract representations for transitive and ditransitive structures [3, 4]. Given these initial findings, recent work has begun to examine more precisely the nature of the syntactic representations that children retrieve when processing sentences [5].

The present study built on this work to explore the locus of syntactic priming effects in children’s language production. Adults exhibit priming between sentences that share constituent but not thematic structure. In a classic study, locative sentences (e.g., *The 747 was landing by the control tower*) primed passives as robustly as did passive primes (*The 747 was alerted by the control tower*) [6]. Note that the locative and passive primes shared function words (i.e. *by*) as well as constituent structure (i.e. NP-VP-PP), but involved different thematic role assignments (patient-agent in passives vs. agent-location in locatives). Later replications suggested that the shared function words were important [7].

We asked whether children are similarly susceptible to priming from shared constituent structure and function words, without shared thematic structure. We used a picture-description task [8] in which 4;6-year-olds (n=33) took turns with an experimenter to describe pictures. The form of the experimenter’s descriptions was manipulated within participants: the prime sentences included passives (*A man was annoyed by the computer*), locatives (*A man was reading by the computer*), and actives (*A man was using the computer*; Fig-1a). As in the adult studies, the locative and passive primes shared constituent structure and the function word ‘by’, but had different thematic structures.

Figure 1a: Active, passive, and locative prime items. Figure 1b: Target item.

Children’s descriptions of transitive events (Fig-1b) were influenced by the primes. Planned comparisons revealed that children produced reliably more passives after passive primes than after either active (13% priming, \( p<.01 \)) or locative primes (11% priming, \( p<.01 \)), but did not produce more passives after locative than active primes (2% priming, \( p=.5 \)).

Thus, hearing a sentence that shared constituent structure and function words but not thematic structure with the passive was not sufficient to prime children’s production of passives. Preliminary results suggest that adult participants show such priming in this task. If
so, then this suggests that different dimensions of sentence structure may differ in their contributions to syntactic priming for children and adults. Thematic role assignments can be primed in adult sentence production independent of constituent structure [9]; thus it is not the case that thematic structure plays no role in syntactic priming in adults. However in this study, to be primed to produce a passive, children required more than its constituent structure and the function word ‘by’; thus the priming of thematic role linking may have played a greater role than the priming of constituent structure or particular function words, for children compared to adults.

References:
What German 5-year-olds know about the constraints on object order in ditransitive sentences: An elicited imitation study

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The linear order of the objects of a ditransitive verb in German is relatively free for full NPs: indirect (IO) and direct object (DO) may appear in either order, IO<DO and DO<IO, with the latter being marked compared to the former. Constraints on the ordering have been proposed to include, among others, definiteness (NP_{DEF}<NP_{INDEF}) and focus (NP_{F}<NP_{I}). Ordering constraints can be conceived of as soft constraints in an optimality-theoretic framework. By assuming that constraints like [DEF<INDEF] and [-F->F] are ranked higher than the constraint working against [DO<IO], these accounts predict a marked order like DO<IO to be relatively acceptable when it fulfills a higher ranked constraint like [DEF<INDEF] or [-F->F] (Müller, 1999). This boils down to an interaction of the markedness constraints on object order, and on definiteness and focus: the relative markedness of the four resulting structures is then ordered as follows: (a)-cases/no violation > (b)-cases/one violation of [DO<IO] > (c)-cases, one violation of [DEF<INDEF] > (d)-cases/two violations.

In order to test whether 5-year-old speakers of German have acquired the constraints and their ordering, we conducted two experiments employing an elicited imitation paradigm — Exp1 testing the effect of focus, Exp2 testing the effect of definiteness on children’s serialization of the objects in sentences as exemplified in (1) and (2). In each experiment, 16 monolingual participants were auditorily presented with five sentences for each of the four conditions (aided by pictures depicting the expressed event), and were asked to repeat the sentences to a deaf and almost blind mole puppet. Exp 1 operationalized focus by a wh-question for the DO or the IO preceding the stimulus sentences together with a nuclear pitch accent on the element asked for. In Exp 2 definiteness was marked by using either the definite or indefinite determiner, with all prosodic information removed from the acoustic stimulus. Children’s imitations were coded for faithfulness to the stimulus sentence. Our first hypothesis was that faithfulness decreases as markedness increases. This was tested by comparing the faithfulness of children’s imitations of sentences from neighbored conditions by repeated contrasts. Our second hypothesis stated that, in unfaithful stimulus-imitation pairs, the imitations should be less marked than the stimulus. Stimulus pairs complying with this hypothesis were compared to those contradicting it in one-sample t-tests.

The data confirmed our hypotheses: markedness had an effect on the faithfulness of children’s reproductions, as it had on the direction of changes in unfaithful stimulus-imitation pairs. In agreement with the optimality theoretic proposal for the adult grammar, children were more tolerant against inputs marked for word order than for focus; in disagreement with the proposal, children were less tolerant against inputs marked for word order than for definiteness. Overall, these are the first results showing that German children’s linearization of objects in ditransitive structures is affected by at least some of the constraints proposed for adult grammar, even though the constraint ranking may still not be adult-like.

References:
(1) a. \( M^\text{--} \): unmarked input (small caps indicate nuclear stress)

\[
\text{Der Mann hat} \ [\text{dem}_{\text{DAT}} \text{ Jungen}]_{\text{IO}} \ [\text{den}_{\text{ACC}} \text{ Ball}]_{\text{focDO}} \text{ gegeben.}
\]

\( \text{The man has} \ [\text{the}_{\text{DAT}} \text{ boy}]_{\text{IO}} \ [\text{the}_{\text{ACC}} \text{ ball}]_{\text{focDO}} \text{ given.} \)

b. \( M^{\text{+FOC}} \): input marked with respect to focus

\[
\text{Der Mann hat} \ [\text{dem}_{\text{DAT}} \text{ Jungen}]_{\text{focIO}} \ [\text{den}_{\text{ACC}} \text{ Ball}]_{\text{DO}} \text{ gegeben.}
\]

\( \text{The man has} \ [\text{the}_{\text{DAT}} \text{ boy}]_{\text{focIO}} \ [\text{the}_{\text{ACC}} \text{ ball}]_{\text{DO}} \text{ given.} \)

c. \( M^{\text{+WO}} \): input marked with respect to word order

\[
\text{Der Mann hat} \ [\text{den}_{\text{ACC}} \text{ Ball}]_{\text{DO}} \ [\text{dem}_{\text{DAT}} \text{ Jungen}]_{\text{focIO}} \text{ gegeben.}
\]

\( \text{The man has} \ [\text{the}_{\text{ACC}} \text{ ball}]_{\text{DO}} [\text{the}_{\text{DAT}} \text{ boy}]_{\text{focIO}} \text{ given.} \)

d. \( M^{\text{++}} \): doubly marked input

\[
\text{Der Mann hat} \ [\text{den}_{\text{ACC}} \text{ Ball}]_{\text{focDO}} \ [\text{dem}_{\text{DAT}} \text{ Jungen}]_{\text{IO}} \text{ gegeben.}
\]

\( \text{The man has} \ [\text{the}_{\text{ACC}} \text{ ball}]_{\text{focDO}} [\text{the}_{\text{DAT}} \text{ boy}]_{\text{IO}} \text{ given.} \)

(2) a. \( M^\text{--} \): unmarked input

\[
\text{Der Mann hat} \ [\text{den}_{\text{DAT}} \text{ Jungen}]_{\text{defIO}} \ [\text{einen}_{\text{ACC}} \text{ Ball}]_{\text{indefDO}} \text{ gegeben.}
\]

\( \text{The man has} \ [\text{the}_{\text{DAT}} \text{ boy}]_{\text{defIO}} [\text{a}_{\text{ACC}} \text{ ball}]_{\text{indefDO}} \text{ given.} \)

b. \( M^{\text{+DEF}} \): input marked with respect to definiteness

\[
\text{Der Mann hat} \ [\text{einem}_{\text{DAT}} \text{ Jungen}]_{\text{indefIO}} \ [\text{den}_{\text{ACC}} \text{ Ball}]_{\text{defDO}} \text{ gegeben.}
\]

\( \text{The man has} \ [\text{a}_{\text{DAT}} \text{ boy}]_{\text{indefIO}} [\text{the}_{\text{ACC}} \text{ ball}]_{\text{defDO}} \text{ given.} \)

c. \( M^{\text{+WO}} \): input marked with respect to word order

\[
\text{Der Mann hat} \ [\text{den}_{\text{ACC}} \text{ Ball}]_{\text{defDO}} \ [\text{einem}_{\text{DAT}} \text{ Jungen}]_{\text{indefIO}} \text{ gegeben.}
\]

\( \text{The man has} \ [\text{the}_{\text{ACC}} \text{ ball}]_{\text{defDO}} [\text{a}_{\text{DAT}} \text{ boy}]_{\text{indefIO}} \text{ given.} \)

d. \( M^{\text{++}} \): doubly marked input

\[
\text{Der Mann hat} \ [\text{einen}_{\text{ACC}} \text{ Ball}]_{\text{indefDO}} \ [\text{dem}_{\text{DAT}} \text{ Jungen}]_{\text{defIO}} \text{ gegeben.}
\]

\( \text{The man has} \ [\text{a}_{\text{ACC}} \text{ ball}]_{\text{indefDO}} [\text{the}_{\text{DAT}} \text{ boy}]_{\text{defIO}} \text{ given.} \)
Lexical preferences in Dutch ditransitives:
From corpus frequencies to controlled production

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Background The choice between a double object (DO) construction and a prepositional object (PO) construction is guided by referential properties of the Theme and Recipient arguments such as animacy and definiteness (Bresnan et al. 2007). In addition, lexical properties of the verb play a role (e.g. Levin 2008, Gries 2005, Pickering and Branigan 2008). Alternating verbs may exhibit a preference for one of the two constructions, as is witnessed by corpus-based research (Gries and Stefanowitsch 2004). However, such distinctive collexeme analyses do not control for argument properties as potential confounding factors. That is, certain verbs may tend to occur with certain argument types which by themselves make for a strong preference in constructional choice.

Research Question Are constructional preferences part of the representation of ditransitive alternating verbs independently of argument properties? An answer to this question will shed further light on the relation between corpus-based studies and controlled experiments in the study of language production.

Method We selected 16 pairs of Dutch alternating ditransitive verbs, one with a DO and another with a PO preference, based on Colleman’s (2006) collexeme analysis. Each pair was combined with a human Agent, a human Recipient and an inanimate Theme argument (all definite NPs):

[1] Agent NP Recipient NP Theme NP DO verb PO verb
de president de wetenschapper de onderscheiding aanbieden overhandigen
‘the president’ ‘the scientist’ ‘the award’ ‘offer’ ‘hand over’

A pre-test assessed the plausibility of each combination in each construction. The 9 most plausible pairs of verbs were included in an oral sentence completion task, following Ferreira (1996). 32 Participants were first given the Agent NP and the auxiliary heeft ‘has’ on a computer screen, followed by 3 words: two definite NPs (Theme and Recipient) and an infinitival verb. The verb always occurred in the middle with either the intended Theme or Recipient above it, in counterbalanced order. Participants were asked to complete the sentence with these 3 words. Their sentences were recorded, transcribed, and coded for the construction type and order of the arguments.

Results Figure 1 summarizes the results. Analyses with a logistic mixed effects model (Baayen 2008, Jaeger 2008) show that the produced construction is not fully determined by the order of presentation. Crucially, we also find an effect of verb type in line with their corpus preferences: DO-verbs produce more DO constructions in both orders of presentation relative to PO-verbs (X2(1): 8.97, p: 0.0027). There was no significant interaction between the two factors.
**Discussion** The results show that speakers have access to verbal preferences for one of the constructional alternatives of the dative alternation, and that these preferences constrain the choice of syntactic structure. This finding is in line with lexically-based grammar formalisms (see Huxley et al. 2007 for further discussion). The data also show that corpus-based and controlled production data exhibit very similar patterns. Hence, the study provides further evidence that corpus research is a good tool for the study of natural language production (see also Bresnan 2007, Jaeger 2010, Gries et al 2005).

**References**
Expectations of discourse salience: An ERP study of argument order preferences for ditransitive verbs

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Words that fail to meet lexical expectations elicited by the verb result in an enlarged N400 effect when compared to the words that are contextually expected (Kutas & Federmeier, 2000; Van Berkum et al., 2005). Such effects have even been observed for the mismatching determiner of an expected noun (DeLong et al., 2005), revealing clear anticipatory, rather than simply integrative, mechanisms. Building on these findings, we examined the influence of discourse salience preferences for generating expectations during comprehension.

Both corpus and behavioral studies have shown that people prefer having salient/given entities mentioned before less-salient/new when ordering the object arguments of ditransitive verbs (Arnold et al., 2000; Bock & Warren, 1985; Clifton & Frazier, 2004). We first conducted a sentence continuation task for sentences such as 1a-d that were cut after the ditransitive verb in German. The result showed that people were more likely to continue the sentence by placing the first-mentioned subject as the first object argument than the second-mentioned entity (p <.05). We then used these materials in an ERP study (1a-1d) to determine the nature of expectations elicited by such a preference. Specifically, the goal was to establish whether violation of the expectation would be revealed at the determiner, suggesting a highly predictive influence, or only during the noun, suggesting integration difficulty. Also of interest is what kind of impact it has, i.e., how long the violation effect lingers. Finally, we examined whether the violation in the order of object arguments is more semantic/thematic or structural in nature.

The second, target, sentence was presented word-by-word in the middle of the screen. ERP signals were time-locked to the onset of the determiners (den/dem) as well as the object nouns. The analyses on the first determiner showed an enhanced late negativity for unexpected order, starting around 600 ms after the determiner onset, while analyses on the first object noun revealed a traditional N400 for the unexpected noun. We therefore assume the effect found after the determiner is in fact the N400 found at the noun. Neither grammatical case of the determiner (accusative vs. dative), nor animacy of the first object noun (Junge vs. Ball), had any influence. Interestingly, the expectation violation did not elicit differing (E)LAN or P600 for the unexpected vs. expected ordering of the arguments. Analyses on the second determiner and the second object noun did not show any lingering effects of recover for the unexpected ordering.

The results suggest that when expectations are violated at the level of thematic roles or information structure, N400 effects are not found on the earlier determiner, as both possible orders are semantically plausible, although not equally preferred. In addition, the effects suggest that the ordering preferences based on discourse salience are not structural in nature (lack of traditional structural effects) but rather affect processing at the level of thematic roles or information structure.
Examples:

1a - expected
Ein Junge ist neben einem Ball im Garten vor dem Haus. Der Vater schenkte dem Jungen den Ball als Geschenk...
‘A boy is next to a ball in the garden of the house. ‘The father gave the boy the ball as a gift...’

1b - expected
Ein Ball ist neben einem Jungen im Garten vor dem Haus. Der Vater schenkte den Ball dem Jungen als Geschenk...
‘A ball is next to a boy in the garden of the house. ‘The father gave the ball to the boy as a gift...’

1c - unexpected
Ein Junge ist neben einem Ball im Garten vor dem Haus. Der Vater schenkte den Ball dem Jungen als Geschenk...
‘A boy is next to a ball in the garden of the house. ‘The father gave the ball to the boy as a gift...’

1d - unexpected
Ein Ball ist neben einem Jungen im Garten vor dem Haus. Der Vater schenkte dem Jungen den Ball als Geschenk...
‘A ball is next to a boy in the garden of the house. ‘The father gave the boy the ball as a gift...’

References:
Comprehension of word order and case marking in Czech: evidence from comprehension studies and structural priming

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An important part of language acquisition is learning the way a particular language marks the agent and patient roles in transitive sentences. In languages that use multiple cues for marking the agent/patient distinction (e.g. German, Croatian), children have problems with sentences where different cues suggest different interpretation (Dittmar, Abbot-Smith, Lieven, & Tomasello, 2008; Slobin & Bever, 1982). The present study used the intermodal preferential looking paradigm and an offline pointing task to examine how Czech 2- and 4-year-olds use case inflection and word order in sentence interpretation. The time course of the preferential looking responses was analyzed to test when children first show signs of using the structural and morphological information from the auditorily presented sentences. Additionally, the preferential looking study tested the abstractness of children’s word order representations by employing structural priming (cf. Savage, Lieven, Theakston, & Tomasello, 2003).

In the preferential looking study, each item consisted of a transitive sentence played to the children and accompanied by two videos. These showed two participants doing the same action but in the opposite roles. The items were organized in pairs, with first sentence (the prime) structurally unambiguous, and the second sentence (the target) temporarily ambiguous:

Primes: Medvěd honí pejsku. / Pejska honí medvěd.
   bearNom chase doggieAcc / doggieAcc chase bearNom
   The bear is chasing the doggie.
Target: Kačátko češe tygra.
   baby duckNomAccAmbig brush tigerNom
   The baby duck is brushing the tiger.

The prime sentences were used to evaluate children’s comprehension of different word orders. The target sentences were used to examine the effects of structural priming. In the offline study, children were shown pairs of pictures with the same participants engaging in the same actions but in opposite roles. The sentences varied in word order, and in whether they were temporarily ambiguous or not. Data from 20 2.5-year-olds and 26 4.5-year-olds were evaluated.

Preferential looking results showed that 2-year-olds tended to switch gaze toward the target picture in SVO but not in OVS prime sentences, suggesting that the former are easier to interpret. Similar pattern was observed in 4-year-olds. Younger children demonstrated structural priming in SVO targets by shifting their gaze to the target sentence more often after an SVO prime than after an OVS prime. Older children showed priming effects in OVS sentences. Overall, the findings confirm that children have an abstract representation of word order at the age of 2.5, but their ability to evaluate noncanonical OVS word orders is still limited at 4.5-years. However, the offline study suggested different pattern. The younger group of children showed above-chance performance in all sentences, and the performance was close to ceiling in the older
group. Differences in comprehension between SVO and OVS sentences were only observed in temporarily ambiguous sentences.

Overall, the findings suggest that children have difficulty with the on-line processing of OVS sentences, but that they have some knowledge of their structure. When provided enough time in the offline task, they perform equally well in OVS and SVO sentences, as long as the sentence-initial words are unambiguously marked for case. Contrary to previous suggestions (Dittmar et al., 2008; Savage et al., 2003), children do not show principal problems with OVS word orders, and they represent word order independently of individual verbs.

![Graphs showing comprehension of SVO and OVS sentences for 2.5-year-olds and 4.5-year-olds.](image)

Figure 1: Results in primes, reflecting children's comprehension of SVO and OVS sentences. Periods: 0 is the baseline (400 ms before sentence presentation), 1, 2, and 3 are fixations initiated during the first, second and third word, 4 is the period 400 ms after the offset of the last word. It is apparent that younger children show faster comprehension of SVO sentences than the older group.

References:
The Processing Of Hard-To-Detect Semantic Anomalies: An ERP Investigation

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Failure to detect semantic anomalies such as, “Where should the survivors of a plane crash be buried?” is taken as evidence for shallow processing in language comprehension (Barton & Sanford, 1994) however the cognitive mechanisms involved are not well understood. What makes these anomalies so interesting is that they present a challenge to models of language processing which assume that processes underlying lexical retrieval and integration are completed immediately and fully (Sanford & Sturt, 2002). Instead, non-detection of these anomalies suggests that readers do not carry out an exhaustive lexico-semantic analysis of all words in a sentence, yet still manage to construct a coherent representation of the message. Given that shallow processing is ubiquitous in language the dynamic properties which determine when and why we process to a particular depth must be fully delineated (Bohan & Sanford, 2008; Ferreira et al., 2002; Ferreira & Patson 2007; Sanford 2002; Sanford & Sturt 2002).

To investigate this Sanford et al. (2011) ran an event-related potential (ERP) study using spoken language materials and analyzed N400 and P600 components of the ERP as indices of semantic processing. They compared survivors-type anomalies (referred to as good-fit anomalies because target words had a good-fit to the global sentential context, as in “survivors” being a word generally associated with disaster-type scenarios such as a plane crash) when they were detected and missed to non-anomalous controls. They also compared these good-fit anomalies to poor-fit anomalies (when target words neither fit the global or local sentential context), as in the word “socks” in, “He spread the warm bread with socks.” These types of anomalies are known to elicit an N400 effect (Kutas and Hillyard, 1980, 1984). They found that poor-fit items elicited a classic N400 effect followed by an enhanced late posterior positivity (LPP), whereas good-fit anomalies only produced a later LPP enhancement. Moreover, LPP amplitude was larger for detected than non-detected good-fit anomalies, and the ERP waveform for the latter condition was indistinguishable from that for the non-anomalous control items.

Here we present an ERP anomaly detection experiment comparing visually presented good and poor-fit anomalies when they are both consciously reported and missed by participants. This study is novel in that we used text overauditory presentation of items and in that we extend our regions of analyses to rule out alternative explanations for why readers fail to detect good-fit anomalies. There were several key findings. Firstly, ERP analyses ruled out the possibility that anomaly non/detection is due to differences in processing prior contextual information or in initial encoding of the critical word. Secondly, our data indicate an important distinction between consciously detected and missed good-fit anomalies. The ERP waveform, starting in the P2 interval, was less positive for non-detected compared to detected anomalies and non-anomalous controls, which we interpret as reflecting a language-driven modulation of visual input processing (Figures 1 & 2). Finally, unlike Sanford et al., we find that detected good-fit anomalies do elicit a reliable N400 effect (though of much smaller amplitude than for poor-fit anomalies) when detection accuracy has been stressed (Figures 1 & 2). We assume that at least some detected good-fit anomalous items lead to a disruption of semantic integration, thereby giving rise to a larger N400 than for non-anomalous items.
Figure 1 (left) Grand-average ERP waveforms elicited at electrodes Fz, Cz, and Pz in the target region for good-fit anomalies that were detected, non-detected, and non-anomalous. The shaded areas represent the P2 (200-300) and LPP (500-900) time windows.

Figure 2 (below) Spline-interpolated topographic maps of mean ERP difference waveforms reflecting the anomaly effect and the detection effect for time intervals 200-250 ms, 250-450 ms, and 600-1000 ms. Top panel: Poor-fit anomaly effect (ERP[anomalous] minus ERP[non-anomalous]). Middle panel: Good-fit anomaly effect (ERP[anomaly-detected] minus ERP[non-anomalous]). Bottom panel: Detection effect (ERP[anomaly detected] minus ERP[anomaly-non-detected]. Isopotential line spacing is 0.3 μV.

References
Propositional truth-value can be a defining feature of a sentence’s relevance to the unfolding discourse, and establishing propositional truth-value in context key to successful interpretation. We investigated its role in comprehension of counterfactual conditionals, which describe imaginary consequences of hypothetical events, and are thought to require keeping in mind both what is true and what happens to be false (Byrne, 2002). Pre-stored real-world knowledge may therefore intrude upon and delay counterfactual comprehension, which is predicted by some accounts of discourse comprehension (e.g., Garrod & Terras, 2000), and has been observed during online comprehension in event-related potential (ERP) and eye-tracking measures (Ferguson & Sanford, 2008; Ferguson, Sanford & Leuthold, 2008). The impact of propositional truth-value may thus be delayed in counterfactual conditionals, as also claimed for sentences containing other types of logical operators (e.g., negation, scalar quantifiers). Yet, the validity of these earlier results stands or falls with the provision of a sufficiently constraining discourse context to ‘overrule’ real-world knowledge. In an ERP experiment, we investigated the impact of propositional truth-value when described consequences are both true and predictable given the counterfactual premise. Thirty participants read 120 negated counterfactual true/false statements in Spanish (approximate translation: “If N.A.S.A. had not developed its Apollo Project, the first country to land on the moon would have been Russia/America”) and real-world true/false statements (“Because N.A.S.A. developed its Apollo Project, the first country to land on the moon was America/Russia”), presented word-by-word, and mixed with 60 non-counterfactual filler sentences. Counterfactual and real-world statements were matched for CW expectancy and for average truth-value rating based on the results of two independent pre-tests. Our hypothesis involved the amplitude of the N400 ERP (Kutas & Hillyard, 1980), which indexes early semantic processing costs and is sensitive to subtle variations in discourse-semantic fit (Kutas, Van Petten & Kluender, 2006). If real-world knowledge disrupts counterfactual comprehension, if only briefly, despite this strong context, then critical words in counterfactually true statements should evoke a larger N400 compared to counterfactually false statements and real-world true statements. In contrast, if incoming words are mapped onto the most relevant interpretive context without delay and without initial regard to real-world truth-value, then false statements should elicit an N400 effect compared to true statements, for counterfactual and real-world statements alike. In line with the latter hypothesis, false words elicited larger N400 ERPs than true words, in negated counterfactual sentences and real-world sentences alike (see Figure 1). These indistinguishable N400 effects of propositional truth-value, elicited by opposite word pairs,
argue against disruptions by real-world knowledge during counterfactual comprehension, and suggest that incoming words are mapped onto the counterfactual context without any delay. Thus, provided a sufficiently constraining context, propositional truth-value rapidly impacts ongoing semantic processing, be the proposition factual or counterfactual.

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Narrative mode affects perspective adoption in sentence comprehension

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During sentence processing, comprehenders generate mental representations of described scenes from particular perspectives ([1],[2]). The perspective a comprehender adopts can be modulated by person. For example, comprehenders tend to adopt an internal perspective (i.e., they take the protagonist's viewpoint) when the subject is 1st or 2nd person (e.g., I or You), but an external perspective (i.e., an outside observer's viewpoint) when it is 3rd person (e.g., He) ([3]). However, within sentences using a given grammatical person, there can be variability in perspective, depending on context. This has been shown for first person language; when the discourse context provides rich information about an actor's identity prior to a critical sentence, comprehenders are more likely to adopt an external perspective([3]). However, it isn't known whether comprehenders ever adopt internal representations in response to third person language. When does a reader project him/herself into the mind and body of a third person protagonist—him or her?

When third person language is used in actual narratives, it displays one of several narrative modes, differing in whether they describe the mental states or just the external appearances of a protagonist. The third person subjective describes information that is only accessible by the character, such as internal thoughts or unexpressed feelings (e.g., She could feel her blood boiling as she looked at the perfume bottle—not her perfume bottle—that she had found in her boyfriend's bathroom). In contrast, the third person objective only describes observable information about that character (e.g., She remained still, but occasionally glanced at the perfume bottle).

(a) Third-person subjective context
(1) She was very uncomfortable because her hands felt sticky and there was still clay under her nails from her ceramics class.
(2) She desperately wanted to wash her hands, but could not see a sink anywhere.
(3) She could feel the clay drying even more an eyed the small towel on the table.
(4) She picked up the hand towel.

(b) Third-person objective context
(1) She appeared out of breath when she rushed into the room.
(2) She looked down at the table, where there was a hand towel.
(3) Her hands were covered with clay, and she glanced back and forth between her clay-covered hands and the towel.
(4) She picked up the hand towel.
In principle, this distinction in narrative mode could affect the perspective that comprehenders adopt; they might be more likely to adopt an internal perspective for the subjective but an external perspective for the objective mode.

We investigated whether these different narrative modes affect what perspective readers adopt during sentence processing. We had 44 native English speakers read four-sentence, third-person stories in one of the two modes. Following [3], they then decided if a pictured event was part of the story. The picture depicted the event from either (a) an internal or (b) external perspective.

(a) Internal perspective  
(b) External perspective

Twenty-four critical sentences and corresponding pairs of internal and external perspective pictures were created and fully crossed to produce matching and mismatching pictures for each item. If third-person subjective narratives lead participants to access an internal perspective, participants should respond faster to internal perspective pictures than to external ones. Conversely, third-person objective narratives should facilitate responses to external perspective pictures. As expected, responses to external pictures were significantly faster after objective narratives than after subjective narratives, and vice versa for subjective narratives (significant interaction effects of Context and Perspective: $F_1(1,51)=6.6, p=0.01; F_2(1,22)=5.5, p=0.03$).

These results suggest that narrative mode affects the perspective comprehenders adopt; objective mode makes people more likely to adopt an external viewpoint in which they see the protagonist as an observer would, while subjective mode makes comprehenders more likely to adopt an internal viewpoint in which they projecting themselves inside the protagonist.

References:
How to make teenagers pay a lot for nothing
When gaze makes a difference: A comparative ERP study of gaze and arrow cues during sentence comprehension

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Eye-tracking studies have shown that language external cues such as gaze and arrows influence both listeners’ visual attention in a similar, but sentence comprehension in a different way (Staudte et al., 2011). In this paper we present findings from two ERP studies, which further investigates this influence of both cue types on language comprehension. In general, our results suggest that distinct processes are involved when sentences are parsed in the context of referential gaze or referential arrows, respectively.

Using stimuli similar to those of Staudte et al. (2011), two groups of 18 German participants each either saw videos of a virtual agent gazing at objects in a scene (1a) or saw similar videos but with an arrow replacing the gaze cue (1b). After the video was presented, participants heard a computer-generated utterance describing the scene: The description was either congruent (2) or incongruent (3) with the linear order of the cues shown in the video (actual stimuli were in German and, crucially, identical for both experiments).

After hearing the sentence, participants had to determine its validity by pressing a button accordingly. Our analysis examined two time windows as indicated by squared brackets in the examples (NP1 and NP2). Table 1 below summarizes the effects found for the incongruent, as compared to the congruent, condition.
Table 1: Summary of the ERPs in both experiments

<table>
<thead>
<tr>
<th></th>
<th>Gaze experiment</th>
<th>Arrow experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>NP1</td>
<td>Sustained negativity (350-1000ms)</td>
<td>- Posterior N400 (300-500ms)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Frontal positivity (300-800ms)</td>
</tr>
<tr>
<td>NP2</td>
<td>Posterior negativity (300-500ms)</td>
<td>Fronto-central positivity (300-800ms)</td>
</tr>
</tbody>
</table>

Gaze experiment:
We suggest that the sustained negativity on NP1 indicates the maintenance of information in working memory (e.g., Donaldson & Rugg, 1999). The processor must maintain two different situation models in memory, namely the gazed-at egg and the mentioned box as two possible referents (see also Coulson & Lovett, 2004). The negativity (N400) on NP2 can be interpreted as integration of the final incongruent NP (e.g. Kutas & Hillyard, 1984; van Berkum et al., 1999) into the recently updated mental model for the sentence.

Arrow experiment:
The integration effect, found on NP2 in the gaze experiment, was now found on NP1. Additionally, we found a fronto-central positivity. This indicates that the processor has integrated the visual cue already on NP1 and updated the mental model. Accordingly, we find a model updating effect (positivity) on NP2 but no sentence final integration effect.

More generally, our results suggest that previously seen referential gaze has an incremental influence on comprehension mechanisms, which arrows seem to lack. Specifically, gaze was shown to establish a competing referent, as suggested by increased memory load on the first incongruent NP. However, a referent that was previously referred to by an arrow did not introduce this kind of memory load and, to the contrary, led to an early integration of visual and sentence information. Crucially, our results highlight that sentence comprehension seems to rely on distinct processing mechanisms when integrating gaze - suggested by the final integration effects (NP2) - compared to arrows – initial integration (NP1) and subsequent updating (NP2).

References:
Severing the tie between the eLAN and automatic syntactic processing
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Current neurocognitive processing models [1,2] map ERP component latency onto discrete processing stages of a serial parser, mapping the early left anterior negativity (eLAN) onto automatic first-stage parsing, as it is elicited between 100-300 ms by purported word category violations that interfere with initial syntactic structure assignments.

Recent studies [3,4,5] have begun to weaken the causal link between word category violations and the eLAN by providing examples of word category violations that do not elicit an early negativity. It has likewise been shown [6] that the eLAN disappears when factors such as probability of violation and context change. Thus, a word category violation is not always sufficient for eliciting an early negativity.

It has thus far been impossible to sever the link between the eLAN and automatic syntactic parsing because there has been little evidence that a word category violation is not necessary to elicit an early negativity. There is some evidence for this, however, from lexical processing (an M100 response to visual form expectation [7]), as well as previously unnoticed or underreported early negativities in response to sentences that crucially do not contain word category violations: an incorrect member of a correct word category [8,9], a pseudoword/nonword in a predictive context [10], and a semantic expectancy violation in a highly predictive context [11,12]. We hypothesize that these early responses (eLAN, M100 and unidentified early negativities) may all be a similar response to an unexpected sensory (either auditory or visual) form.

To test this hypothesis, we conducted an ERP study to determine whether a violation of visual form expectancy alone would elicit an early negativity (similar to the eLAN) in a sentence context. The study used idioms normed for greater than 95% cloze probability in order to guarantee that only one visual form was expected, and compared ERP responses to the final word of idiomatic phrases, with either their expected completion (1) or a visually unexpected, yet syntactically correct and semantically plausible completion (2). For the current study, word length and phonotactics were used to render (2) visually different from (1). Thus critical words were controlled for frequency, semantic content, and preceding context, but not word length. Each participant read 60 experimental, 60 control, and 120 filler sentences, presented one word at a time with an SOA of 500 ms.

The visually unexpected ("sentences") vs. expected ("words") comparison elicited:
(i) an anterior early negativity and
(ii) an N400 effect.

This provides concrete evidence that a word category violation is not necessary to elicit an early negativity in a sentence processing context. It also provides preliminary evidence that an early negativity can be elicited not just by syntactic violations, but at various levels of linguistic processing (i.e. both syntactic and semantic) based on expectation of word forms. A word category violation is therefore neither sufficient nor necessary for the elicitation of an early negativity, and the link between the early negativity and an automatic stage of syntactic processing should be reconsidered.
(1) A picture is worth a thousand words.
(2) A picture is worth a thousand sentences.

Inanimacy as a cue to derived subjects: Evidence from the development of the "semantic" P600

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While classically assumed to reflect structural processes, the P600 event-related potential (ERP) component has recently been argued to reflect semantic processes elicited by thematic reversibility violations (Kim & Osterhout, 2005; Kuperberg et al., 2003). These results have led to theories arguing that this semantic P600 is a response to two competing streams of information: a semantic stream which processes thematic relationships and a syntax stream which processes structural relationships (Kuperberg, 2007). Here, we propose and test an theory in which this “semantic” P600 is driven by the parser’s predictive use of inanimacy cues to build derived subject structures which later require structural reanalysis. We further test the hypothesis that cues to thematic role assignments, such as animacy, are less accessible to children, leading to weaker predictions and attenuated reanalysis processes.

Ambiguity is a pervasive problem for comprehension; even sentential subjects fall prey to ambiguities of thematic interpretation. Comprehenders are faced with a choice when parsing a subject: while sentential subjects are generally interpreted as agents (1), passive subjects, for instance, receive theme interpretations derived through underlying object positions (2). One possible cue to the presence of derived subjects is animacy. Inanimate subjects must be derived because agent interpretation requires an animate subject, while theme interpretation carries no such requirement (Dowty, 1991). Since animacy is known to affect the production and comprehension of derived subjects (Feurira, 1994, 2000), rapid use of a subject’s inanimacy could cue the parser to predictively construct a derived subject structure which may later require revision. Interestingly, this mechanism appears to be late developing children’s variable use of animacy (Drenhaus & Féry, 2008; MacWhinney, Bates, & Kliegl, 1984). Without a deep understanding of animacy cues, children may rely on the default agent-first strategy in which subjects are assigned agent interpretations (Townsend & Bever, 2001).

To determine whether adults and children use subject inanimacy to rapidly predict derived subjects, we recorded ERPs from 17 adults (18-22 years) and 17 children (7-9 years). Participants read sentences like (3) and (4) word-by-word. Results of two spatial-temporal principal components analyses revealed differences in ERP components elicited within conditions and between groups. Adults exhibited a P600 to critical verbs in which inanimacy cues erroneously predicted a derived subject, (3a) vs. (3b) (Figure 1). We argue this P600 in adults indexes a structural reanalysis that rejects the derived subject structure (initially triggered by the inanimate subject) as being incompatible with active verbal morphology. When animacy cues did not predict a derived subject, adults elicited an N400 and no P600, (4b) vs. (4a). We argue this N400 in adults indexes semantic integration costs of pursuing the agent-first strategy licensed by an animate subject. Since no structural revision was necessary, no P600 was elicited. In contrast to adults, children exhibited an N400 to critical verbs regardless of subject animacy, (3a) vs. (3b) and (4b) vs. (4a) (Figure 2). We argue these N400s in children index an indiscriminate use of the agent-first strategy regardless of subject animacy. Since children never predictively pursue derived subject structures, no structural revisions were necessary and no P600s were elicited.

These results have implications for child language/literacy development, and provides support for the view that the P600 indexes processes involved in conflict resolution given competing sources of bottom-up and top-down information during language processing.
Figure 1. Virtual ERPs and Spatial Distribution of the P600 effect for Adults: Active Controls (solid line) to Active Violations (dotted line)

![Virtual ERPs and Spatial Distribution of the P600 effect for Adults](image)

Figure 1. Virtual ERPs and Spatial Distribution of the N400 effect for Children: Active Controls (solid line) to Active Violations (dotted line)

![Virtual ERPs and Spatial Distribution of the N400 effect for Children](image)


Tracking the time-course of agreement processing: Unagreement in Spanish

Agreement processing is here analyzed using a phenomenon available in Spanish – Unagreement-in which a person mismatch between a plural subject and a verb nonetheless produces a well-formed sentence (see 1b). In these sentences, the verbal person value is superimposed onto the nominal one, thus shifting subject interpretation from “The journalists” to “We journalists” and ensuring correctness.

We initially assessed how Spanish speakers evaluated Unagreement compared to both Standard agreement and ungrammatical Person Mismatches. A delayed and an online grammaticality judgment (GJ) task were designed where participants read 120 sentences divided into three experimental conditions (see 1). In the delayed GJ task, 20 participants read the material word-by-word and gave their judgment at the end of the sentence. A main effect of condition was found (F(2,38)=10.63, p<.001). Response times (RTs) for person violations were significantly shorter (465 ms) than for the Control (533 ms) and the Unagreement (532 ms) conditions. No difference emerged between Unagreement and Control. In the online GJ, the whole sentence was presented and participants (n=34) were asked to give their judgment after reading it. A main effect of condition emerged (F(2,60)=24.42, p<.001), arguably due to the significantly faster rating given to person-anomalous sentences (2.9 sec) compared to both Control (3.8 sec, p<.05) and Unagreement (3.9 sec, p<.01) sentences. No difference emerged between Unagreement and Control.

A subsequent eye-movement experiment focused on more fine-grained measures to evaluate the real-time processing of the different agreement patterns. Twenty-four Spanish participants read the same sentences as in the previous experiments. Six eye-movement measures were analyzed on the verb: 1) first-fixation duration; 2) gaze duration (duration of all fixations before leaving the target); 3) total reading time (duration of all fixations, including re-reading); 4) go-past time (time from first fixing the target to first moving forward, including re-reading earlier parts); 5) probability of regression to the target; 6) number of regressions to the target. Unagreement elicited longer gaze duration (F(2,46)=8.45, p<.05), total reading times (F(2,46)=24.31, p<.01) and a higher probability of regression (F(2,46)=5.55, p<.05) than Control. Person anomalies elicited longer gaze-duration times (F(2,46)=8.45, p<.001) and more regressions (F(2,46)=3.47, p<.01) compared to Control, together with greater total (F(2,46)=24.31, p<.001) and go-past (F(2,46)=22.76, p<.001) times. The comparison between Unagreement and Person Mismatch revealed shorter total (F(2,46)=24.31, p<.01) and go-past (F(2,46)=23.82, p<.001) times for the former condition.

The emergence of an incongruity effect in early measures suggests the parser’s sensitivity to feature inconsistency, regardless of whether a seeming or true person mismatch is involved (Mancini et al. in press). Later, the costly person shift required for Unagreement comprehension is reflected in the longer total reading times and the slower RTs required to assess its grammaticality. The consequences of this shift are however more short-lived compared to those of person anomalies. Overall, these findings support the hypothesis that in agreement comprehension two distinct phases can be identified: a feature-checking stage, to check feature consistency and the presence of possible anomalies (cf. Molinaro et al. 2011), and a later stage responsible for evaluating grammaticality and assigning an interpretation to the dependency.

References:


Examples:

(1) a. Los periodistas **escribieron** un artículo muy interesante
The journalists wrote an article very interesting

‘The journalists wrote a very interesting article’

b. Los periodistas **escribimos** un artículo muy interesante
The journalists wrote an article very interesting

‘We journalists wrote a very interesting article’

c. *El periodista **escribiste** un artículo muy interesante
The journalist wrote an article very interesting

‘The journalist wrote a very interesting article’

![Figure 1. Mean RTs for the three experimental conditions in the on-line GJ.](image1)

![Figure 2. Mean RTs (in msec) for the three experimental conditions in the eye-tracking experiment (gaze duration and total reading times variables)](image2)
Sentence revision difficulties in French-speaking children and adults: Evidence from wh-questions with filled-gaps

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Cross-linguistic research on filler-gap dependency processing has shown that gaps are created actively in advance of concrete evidence, regardless of whether the gap position is pre-verbal (verb-final languages) or post-verbal (verb-medial languages) [1-4]. However, little is known about whether the same revision processes are triggered in both types of languages when active gap creation is disconfirmed by later-arriving information, such as filled-gaps. The variation in error signal position could implicate different degrees of commitment to revise: Post-verbal filled-gaps in English or French arrive after the wh-verb semantic association is completed, whereas pre-verbal filled-gaps in Japanese arrive before the semantic associations could be completed. Here, we address this question by investigating French-speaking adults and children’s comprehension of wh-questions with post-verbal filled-gaps (1), and compare it to comprehension of the Japanese counterpart with pre-verbal filled-gaps reported in [5]. We show that French and Japanese children equally fail to revise due to their general syntactic revision difficulties [6], whereas French adults, who succeed more than children, nevertheless fail to revise more often than Japanese adults.

(1a) French ambiguous question
Où est-ce qu’Aline a expliqué qu’elle allait attraper des papillons?
Where Q Aline has explained that she went catch some butterflies
“Where did Aline explain that she was going to catch butterflies?”

(1b) French filled-gap question
Où est-ce qu’Aline a expliqué dans le salon qu’elle allait attraper des papillons?
Where Q Aline has explained in the room that she went catch some butterflies
“Where did Aline explain in the living room that she was going to catch butterflies?”

We used a Question-after-Story comprehension task following [5]. In each cartoon story a character visits three locations, one of which is host to the main clause event (e.g., explaining in (1)) and another to the embedded clause event (e.g., butterfly-catching). Participants answered a target wh-question after the four critical stories per condition. Two conditions for the wh-question include an ambiguous condition in which both main and embedded clause answers are possible (1a), and a filled-gap condition in which the main clause gap position is occupied by an overt locative PP (1b).

Data from French 6-year-old children (n=20) and adults (n=24) show interesting similarities and differences from the Japanese data in [5] (see Figure). In the ambiguous condition, French adults and children prefer main clause attachment (Adult:74%, Child:75%). This is consistent with the first verb (i.e. embedded verb) attachment preference observed in Japanese adults and children (Adult:92%, Child:94%) [5], and establishes that the off-line interpretation preference reflects the active wh-attachment to the first interpretive position [3,4]. In the filled-gap condition, French children strongly preferred main clause attachment despite the presence of filled-gap in the main clause (13% revision success). The degree of reanalysis failure was similar to that of Japanese children (17% success), and the lack of language influence confirms children’s general difficulties in sentence revision [6]. However,
adults’ data show a novel language influence in revision success: French adults showed a weak embedded clause attachment preference (65%), suggesting that they were able to revise the initial wh-attachment though not consistently, whereas Japanese adults were at ceiling in revising the initial analysis (95%).

**Figure.** The left figure shows the proportion of first verb attachment in French and Japanese ambiguous conditions. The right figure shows the proportion of successful revision in French and Japanese filled-gap conditions.

We propose that the greater reanalysis difficulty in French reflects the multiple levels of representations that require revision: Active gap creation in French occurs at the verb and completes both syntactic dependency and related semantic/discourse representations, but in Japanese it only allows syntactic dependency completion, which alone is too difficult for children to revise. Implications for models of sentence reanalysis will be discussed [7,8].

References
On-line Evidence for Constructional Meaning
Matt A Johnson & Adele E Goldberg
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Contact: majthree@princeton.edu (Matt A Johnson)

There is a growing consensus that it is important to distinguish a verb’s inherent or “core” lexical semantics from the semantics associated with the grammatical structures in which the verb can occur (Goldberg, 1992, 1995; Jackendoff, 1997; Rappaport Hovav & Levin, 1998). Many theoretical arguments for this position have been offered (Goldberg 1995), and there have also been a few off-line experimental studies indicating the link between syntax and semantics as well (Goldwater & Markman, 2009; Kaschak & Glenberg, 2000). For example, participants instructed to sort sentences by ‘overall meaning’ were equally as likely to sort based on main verb(give) as they were by construction(ditransitive)(Bencini and Goldberg, 2000).

However, there have yet to be any on-line experimental evidence that constructional meanings are accessed automatically, independently of the main verb. The present study provides just this evidence using a lexical decision task. In particular, we investigate whether skeletal syntactic forms prime: a) their highest frequency main verb, b) a lower-frequency main verb, and c) a semantically related verb that does not itself regularly occur in the construction.

<table>
<thead>
<tr>
<th>Constructions</th>
<th>High frequency associate</th>
<th>Low frequency associate</th>
<th>Semantically related-non</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ditransitive</td>
<td>Gave</td>
<td>Handed</td>
<td>Transferred</td>
</tr>
<tr>
<td>Resultative</td>
<td>Made</td>
<td>Turned</td>
<td>Transformed</td>
</tr>
<tr>
<td>Caused-motion</td>
<td>Put</td>
<td>Placed</td>
<td>Decorated</td>
</tr>
<tr>
<td>Removal construction</td>
<td>Took</td>
<td>Removed</td>
<td>Ousted</td>
</tr>
</tbody>
</table>

*Table 1: Experimental target words for each construction. The same target words were used following incongruent constructions to determine baseline RTs for each word.*

Prime sentences were created using all nonsense open class words. Nonse words were chosen randomly from a set of 75 forms that had the typical morphophonological form of verbs (25), nouns (25), or adjectives (25). Example sentences for each construction type are given in Table 2:

<table>
<thead>
<tr>
<th>Abstract construction</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ditransitive: He/She nonse-verb-ed him/her the nonse-noun.</td>
<td>&quot;He daxed her the jorp&quot;</td>
</tr>
<tr>
<td>Resultative: He/She nonse-verb-ed it nonse-adjective.</td>
<td>&quot;She jorped it miggy&quot;</td>
</tr>
<tr>
<td>Caused-motion: He/She nonse-verb-ed it on the nonse-noun.</td>
<td>&quot;He lorpded it on the molp&quot;</td>
</tr>
<tr>
<td>Removal: He/She nonse-verb-ed it from him/her.</td>
<td>&quot;She vakoed it from her&quot;</td>
</tr>
</tbody>
</table>

*Table 2: The four abstract phrasal constructions used as primes*

Participants were instructed to read the prime sentence aloud (2000ms), then respond as quickly as they possible to the target word which directly followed it (up to 1000ms), indicating via button press whether it was a word or a non-word. Half of these target words were real, while half were non-words.
Results demonstrate that reaction times to high frequency associated words after related constructions (e.g., give after the ditransitive) were decreased an average of 111 ms when compared with the same words after unrelated constructions (e.g., give after the removal construction). RTs to lower frequency words (e.g., handed after the ditransitive) decreased an average of 77 ms, and semantically related non-associates (e.g., transferred after the ditransitive) decreased an average of 59 ms (see table 3). One-way ANOVAs found each of these three categories to be significant by subject: strong associate = F(1, 136) = 43.5, p < .001; weak associates = F(1, 153) = 21.7; p < .001; semantically related non-associates = F(1, 140) = 6.9, p = .009. However, considering each of these by item, we only find significant effects for strong (F(2, 7) = 125.8, p < .001), and weak associates (F(2, 7) = 7.2, p = .036). Semantically related non-associates were not significant by item (F(2, 7) = 1.6, p = .25).

<table>
<thead>
<tr>
<th>Construction</th>
<th>High frequency associate</th>
<th>Low frequency associate</th>
<th>Semantically related, non-associate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ditransitive</td>
<td>Gave</td>
<td>Hand</td>
<td>Transferred</td>
</tr>
<tr>
<td>Resultative</td>
<td>Made</td>
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<tr>
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<td>Put</td>
<td>Placed</td>
<td>Decorated</td>
</tr>
<tr>
<td>Removal</td>
<td>Took</td>
<td>Removed</td>
<td>Ousted</td>
</tr>
<tr>
<td>Totals</td>
<td>111</td>
<td>77</td>
<td>59</td>
</tr>
</tbody>
</table>

Table 3: Incongruent – Congruent reaction times for all target words, and their totals by category

Associates were primed more than semantically related non-associates to the extent expected by previous studies (for overview see Lucas 2000). At the same time, the priming for non-associates was statistically significant by subject, indicating that the abstract constructions primed corresponding semantically related words, even when those words rarely if ever occur in the constructions. This provides evidence that the constructions, even when devoid of contentful open class words, evoke semantic representations.

References:


The Priming Effect of Mapping Principles on the Processing of Ambiguous Metaphors in Mandarin Chinese

Shu-Ping Gong¹ and Kathleen Ahrens²
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In recent years, there has been growing interest in exploring how conceptual mappings between source and target domains are constructed and processed during the comprehension of conceptual metaphors (Bowdle & Gentner, 2005; Gentner, 1983; Glucksberg, 2003; Glucksberg & Keysar, 1990; Gibbs, 1994; Gibbs et al., 1997; Fauconnier, 1994; Fauconnier & Turner, 1998; McGlone, 1996, 2007; Lakoff & Johnson 1980, Lakoff 1993). In past studies, three mapping accounts have been proposed: the category-based accounts (i.e., the Attribution Categorization Model, Glucksberg et al., 1997), the alignment-based account (i.e., the Structural Mapping Model, Gentner & Wolff 1997) and the principle-based account (i.e., the Conceptual Mapping Model, Ahrens 2002, 2010). Even though each account received empirical evidence from psycholinguistic experiments, the three models did not answer the question of whether all mappings between source and target domains affect the processing of metaphors. In particular, are some mappings more salient than the others to facilitate the processing of conceptual metaphors?

This study aims to determine what conceptual mappings between source and target domains are able to facilitate the processing of ambiguous metaphors (i.e., “X IS Y” metaphors). We examined whether the mapping principles (MPs), i.e., underlying reasons, occur in metaphors constructions and can determine which conceptual mappings can facilitate the processing of metaphors (Ahrens 2010). If mapping principles are involved in the processing of metaphors, we expect that concepts that follow mapping principles are able to facilitate the processing of metaphors while those that do not follow mapping principles can not elicit the facilitation effect.

A priming task was conducted in this study. Thirty-eight “X IS Y” metaphors were primed by two conditions of lexical items (Table 1). One condition of the primes was a lexical item that followed mapping principles. The other condition of primes was a lexical item that did not follow mapping principles. For example, the “X IS Y” metaphor in Chinese 大轉就是機器 dànmào jiùshì jīqí MIND IS MACHINE would be primed by either the word 運轉 yùnzhuǎn “operate” or the lexical item 精密 jīngmì “accurate”. The former was the one that followed the mapping principle of MIND IS MACHINE: “Mind is understood as machine in that machine involves physical operation and mind involves emotional operation” (Ahrens 2010), and the latter did not follow the mapping principle. The 38 “X IS Y” metaphors with their primes were selected from our previous production study (Ahrens & Gong, 2010), in which participants saw 38 “X IS Y” metaphors and were instructed to interpret their meanings. We analyzed the interpretations of the participants and classified them into two groups. If their interpretation is relevant to mapping principles, it would be classified to be the prime following mapping principles. If the interpretation is not relevant to mapping principles, it would be classified to be the one not following mapping principles.

In addition, word frequency of two conditions of primes was controlled (196 vs. 227) and there was no significant difference between two conditions of primes (t (71) = -0.350, p > .05). Furthermore, the level of semantic relatedness between primes and the source domain in “X IS Y” metaphors in two conditions were well balanced. For example, in the MIND IS MACHINE, both 精密 jīngmì “accurate” (i.e., the condition not following MPs) and 運轉 yùnzhuǎn “operate” (i.e., the one following MP) are the primes for 大轉就是機器 dànmào jiùshì jīqí MIND IS MACHINE. In addition, the two primes related to source domain of
MACHINES. We had to balance the level of semantic relatedness between 精密 “accurate” and 機器 “machine” and between 運轉 “operate” and 機器 “machine”. We used the Chinese Latent Semantic Analysis (http://www.lsa.url.tw/modules/lsa/), a technique in natural language processing for measuring the level of relevance between a set of concepts, for controlling the semantic relationship between primes and their source domains (Chen et al. 2009, Kintsch 2002, Landauer & Dumans 1997). The results of the pretest conducted via the tool of Chinese LSA showed no significant difference between two conditions of stimuli (0.25 vs. 0.23, t (68) = - .382, p > .05).

Table 1: Example Stimuli in the Priming Task

<table>
<thead>
<tr>
<th>Prime as MPs</th>
<th>Prime as non-MPs</th>
<th>“X IS Y” Metaphors</th>
</tr>
</thead>
<tbody>
<tr>
<td>運轉 yùnzhuàn “operate”</td>
<td>精密 jīngmì “accurate”</td>
<td>MIND IS MACHINE</td>
</tr>
<tr>
<td>治療 zhíliáo “cure”</td>
<td>麻醉 mázuì “anaesthetize”</td>
<td>HAPINESS IS MEDICINE</td>
</tr>
<tr>
<td>基礎 jīchū “base”</td>
<td>水電 shuídiàn “waterpower”</td>
<td>THEORY IS BUILDING</td>
</tr>
</tbody>
</table>

Forty-two college students from National Chiayi University in Taiwan took part in this task and were assigned to one of two lists randomly. They were instructed to read each prime-target pair and judge the relatedness level between the prime and the target of “X IS Y”. The reaction time was measured from the onset of the target to the moment when participants made their judgment by pressing the button. The experimental results show that the reaction time of metaphors primed by concepts following MPs is significantly shorter than those primed by concepts not following MPs (1168.9 ms vs. 1303.1 ms, t(41) = -3.4558, p < .05). The findings of this study suggest that when a source domain is mapped to a target domain for constructing the meanings of metaphors, not all conceptual mappings between source and target domains are salient to facilitate the processing of ambiguous metaphors. Indeed, only the concepts that follow mapping principles are selected and activated in the processing of metaphors. To conclude, the mapping principles are crucial to determining the salient and non-salient mappings for processing conceptual metaphors. This study has theoretical implication that mapping principles do occur in metaphor constructions and are accessed during the processing of metaphors. This study supports the principle-based account, i.e., Conceptual Mapping Model.

Figure 1: Reaction times for “X IS Y” metaphors primed by either the lexical item following mapping principles or the one not following mapping principles
References:
Fluent speech, uncertainty, and spoken word recognition

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Most of what we know about spoken word recognition comes from studies of words presented in isolation, in tasks such as lexical decision, naming, or gating. Relatively few studies have examined recognition of spoken words in non-constraining sentence contexts (vs. contexts designed to generate expectations for specific words; e.g., [5]). Many of these have used the visual world paradigm (VWP). Some (e.g., [1]) have suggested that the dynamics of lexical competition are at least subtly different from the dynamics inferred from isolated word recognition tasks. The differences have been attributed to measurement differences (e.g., the claim that the VWP provides a more sensitive estimate of the time course of lexical processing). We examined another possible source of the differences: the use of isolated words vs. words presented in fluent sentences. Presentation in fluent speech has the potential either to reduce competition due to additional cues to upcoming segments via coarticulation or to change competition dynamics by reducing certainty about word onset.

In three VWP experiments, we compared time course estimates of competition based on overlap in phonology (cohorts [onset competitors], rhymes) and semantic features (near and distant semantic neighbors [4]). In each study, there were 12 trials with each competitor type. Targets were displayed along with one potential competitor and two unrelated items. There were 48 filler trials. Trials order was randomized. On each trial, pictures were displayed for 1300 ms, and then speech stimuli began. Participants clicked on named items as we tracked their eye movements. Targets were produced fluently in a carrier phrase ("find the shoe", Experiment 1), recorded and presented in isolation ("shoe", Experiment 2), or were isolated words excised from fluent carrier phrases (Experiment 3). Speech was produced sufficiently carefully that the excised words were completely clear, and accuracy was above 94% in all experiments, with no reliable differences between experiments. Fixation proportions were calculated using standard methods [1,4], timed relative to target word onsets.

Fixation proportions over time were analyzed using growth curve analysis [3]. Given space constraints, we show difference scores in Figure 1 (mean competitor proportion minus mean unrelated baseline from 200-1000 msecs after target word onset); we will present time course in our poster. In Experiment 1 (carrier phrase, n=24), we found reliable competition effects for cohorts, rhymes, and near and distant semantic neighbors. In Experiment 2 (isolated words, n=23), cohort effects increased, while semantic neighbor effects diminished and rhyme effects disappeared. In Experiment 3 (n=23), we presented isolated words excised from the fluent carrier phrases to test whether differences between Experiments 1 and 2 were due to coarticulation or onset uncertainty. The results of Experiment 3 were qualitatively intermediate between Experiments 1 and 2 (middle bars in Figure 1), but statistically, it patterned with Experiment 2. In particular, rhymes were not fixated reliably more than unrelated items, suggesting that onset uncertainty changes induced by using carrier phrases changes the dynamics of lexical competition.

It is surprising that a predictable, repeated carrier phrase increases uncertainty, even with carefully articulated speech, and despite potential anticipatory coarticulatory cues to target onset. The clear linear trends in Figure 1 suggest this is really the case; excising words from carrier phrases decreases cohort competition and increases competition from other competitor types relative to the carrier phrase condition. The fact that cohort effects were stronger for isolated words than excised words suggests that excising words decreases phonetic quality
for word onsets (though accuracy was not reliably different for excised words). These changes in phonological competitor effects are consistent with TRACE [2]. An unambiguous onset preceded by silence maximally activates lexical items based on phonological forms, and so strongly activates the onset cohort. Greater initial cohort activation dampens rhyme effects because this boosts the temporal head-start for cohorts [1], enhancing inhibition of rhymes and semantic competitors by cohorts. In contrast, when the word is preceded by a carrier phrase – even one that is perfectly clear, predictable and repeated on every trial – onset cohort items must compete with the lexical items activated by the carrier phrase. This inhibits initial activation of the onset cohort, in turn allowing greater activation of items such as rhymes and semantic competitors.

Our results have serious implications for extant knowledge about word recognition, as they suggest that the generalization of studies of isolated word recognition to word recognition in the context of fluent speech "in the wild" is limited. Specifically, studies with isolated words underestimate the degree of phonological and semantic competition in fluent speech.

References:
Quantifying cue trading in word decoding tasks

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²Max Planck Institute for Psycholinguistics, Nijmegen

Listeners can make use of multiple acoustic cues for each phonological contrast. It is well known that the absence of some cues may be compensated by the presence of other cues. In this paper, we investigate cue trading in the broader context of speech processing by using a computational model of human word processing (cf. Werker & Curtin, 2005). Cue trading has been considered an explanatory mechanism for phoneme perception, see e.g., the Fuzzy Logical Model of Perception (FLMP; Massaro & Oden, 1980) and normal a posteriori probability (NAPP) models [Nearey, 1997]. Both NAPP and FLMP deal with probabilistic phone classification and treat cue weighting as a category-dependent process. This, however, leaves open the question to what extent cue trading plays a role in the context of word or speech processing – which is a broader context than speech sound categorization which has been the more conventional context in which cue trading has been studied. The here presented approach allows a precise quantification of the amount of cue trading as observed during speech decoding on a speech corpus.

Cue trading must be learned. It therefore makes sense to seek for mechanisms that explain cue integration and weighting as a result of an acquisition process. Toscano & McMurray (2010) show that cue-weighting provides a good fit to the perceptual data, but only when the weights emerged through the dynamics of learning. In line with Toscano & McMurray (2010), we address cue trading as a result of learning. We developed a method to quantify cue trading between articulatory features (AFs, e.g. Browman & Goldstein, 1992) as operational during a word decoding task. AFs describe the speech signal in terms of estimated values of, e.g., manner and place of articulation (see Table I). This representation allows more freedom in the description of the speech signal than the phoneme description.

The model used is HMM-based. In this model, the phone models were conventionally defined as Hidden Markov Models and lexical items were defined in terms of sequences of phones. In contrast with conventional ASR training, however, the phone models were initiated (without training) by using canonical articulatory feature definitions according to table I. The HMM paradigm enables us to adapt these parameters during an actual decoding task, such that the resulting parameters can be interpreted as cue weights (cf. McMurray, Aslin, Toscano, 2009). The cue weights are directly interpretable as measures of sensitivity to changes in any of the features. This method relates to the way Clayards, Tanenhaus, Aslin, and Jacobs (2008) demonstrated (for a different task) that artificially manipulating the variance of an acoustic cue changes how listeners weight it perceptually.

The model was applied on 2000 Dutch utterances from the database CAREGIVER (Altosaar et al., 2010). To that end, these utterances were represented as sequences of vectors with AFs. Figure 1 shows the found optimal phone-dependent cue weighting for each of the 33 features, in six situations: without any training and after each of in total 5 adaptations. Of all the AFs considered, manner and place are the most relevant ones (as shown by the higher weights in Figure 1) in terms of their contribution during word competition and word decoding.

In summary, this model is able to find the cue trading within the AF representation by using actual speech, and in a psycholinguistically interpretable way. It will be used in an update of Fine-Tracker (Scharenborg, 2010).


Table 1. Specification of the articulatory features. Nil denotes ‘non-applicable’.

<table>
<thead>
<tr>
<th>AF</th>
<th>AF value</th>
</tr>
</thead>
<tbody>
<tr>
<td>manner</td>
<td>plosive, fricative, nasal, glide, liquid, vowel, retroflex, silence</td>
</tr>
<tr>
<td>place</td>
<td>bilabial, labiodental, alveolar, palatal, velar, glottal, nil, silence</td>
</tr>
<tr>
<td>voice</td>
<td>+voice, -voice</td>
</tr>
<tr>
<td>fr-</td>
<td>front, central, back, nil</td>
</tr>
<tr>
<td>back</td>
<td></td>
</tr>
<tr>
<td>round</td>
<td>+round, -round, nil</td>
</tr>
<tr>
<td>height</td>
<td>high, mid, low, nil</td>
</tr>
<tr>
<td>dur-</td>
<td>long, short, diphthong, silence</td>
</tr>
<tr>
<td>diph</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Cue trading (weights) as a result of learning. Relevance (weight) of the AF components, shown for the baseline (dashed curve) and after N iterations, where N=1 to 5.
Clausal organisation and the choice of referring expressions
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How does the structuring of the discourse influence the choice of referring expressions? Research has shown that the more linguistic material intervenes between a referring expression and its antecedent, the more explicit referring expressions (e.g., repeated names rather than pronouns) tend to be produced (Ariel, 1990; Givón, 1983). This suggests that as the intervening linguistic material increases, the accessibility of the antecedent decreases, affecting the choice of referring expression. What is less clear is how the effect of referential distance is modulated by the structural relationship between the antecedent sentence and the intervening material. Three written sentence completion experiments investigated this.

Kameyama (1998) argued that discourse structure is strictly clause-based, such that the referent should be more accessible when it was mentioned in the immediately preceding clause than in an earlier clause, but this should not be modulated by the specific structure of the clauses. Experiment 1 tested this possibility. Participants produced a new sentence following two separate sentences (1a) or coordinated clauses (1b).

1 a. Rachel discovered the cave. Douglas was lying on the beach.
   b. Rachel discovered the cave and Douglas was lying on the beach.

We examined how they referred to the person in either the first (NP1) or second clause (NP2). If discourse structuring is strictly clause-by-clause, fewer pronouns (relative to names) should be used for NP1 than NP2 and this recency effect should be the same in (1a) and (1b). However, the results showed that the recency effect was significantly larger when referring to entities mentioned in a separate sentence (1a) than a coordinated clause (1b).

Experiment 2 investigated whether the level of syntactic embedding of the preceding sentence affects the choice of referring expression. Researchers have argued that entities in a main clause are more accessible than those in a subordinate clause (Cooreman & Sanford, 1996; Miltsakaki, 2002; Morrow, 1985), so the recency effect may be smaller when NP2 is in an embedded subordinate clause (2a) than a coordinated clause (2b).

2 a. Rachel explored the cave while Douglas was lying on the beach.
   b. Rachel explored the cave and Douglas was lying on the beach.

Our results confirmed this prediction: Whereas participants produced more pronouns (and fewer names) when referring to NP2 than NP1 following (2b), there was no such recency effect following (2a).

Experiment 3 further investigated the effect of syntactic embedding by reversing the order of the main and subordinate clause (3).

3 a. Rachel explored the cave while Douglas was lying on the beach.
   b. While Rachel explored the cave, Douglas was lying on the beach.

In addition to a main effect of recency, we also found a main effect of clausal status (main/subordinate), with significantly more pronouns for entities mentioned in the main than the subordinate clause.

Together, the results suggest that the choice of referring expression is determined by the linear distance between the antecedent and the referring expression as well as the level of syntactic embedding of the preceding sentence.
The resolution of null and overt subjects in Italian and Spanish: a cross-linguistic comparison
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The University of Edinburgh
contact: francesc@ling.ed.ac.uk

This study investigates the cross-linguistic differences between Italian and Spanish regarding their discourse-pragmatic biases on the interpretation of personal subject pronouns. It also tries to identify possible links between such cross-linguistic differences and other morpho-syntactic differences related to the verbal morphology.

Spanish and Italian are two typologically related and morpho-syntactically similar languages, which have been assumed to instantiate the same setting of the null subject parameter with respect to not only its syntactic licensing conditions, but also the pragmatics determining the distribution of null subjects (NS) and overt subject pronouns (OSP). This assumption has had important implications for cross-linguistic research, particularly investigating language acquisition and loss (see for example Sorace et al., 2009).

The first aim of this study was to test directly this assumption. In order to do so, we run two pairs of self-paced reading experiments using the same materials translated in each language, so that the results were directly comparable. The first experiment used the same (Italian) materials and method as Carminati’s (2002) study on antecedent preferences for Italian intra-sentential NS and OPS anaphors, testing the ‘Position of Antecedent Strategy’. Below is an example of sentence tested, the forward slashes indicate the text that was presented together.

(1) Ita. a. Quando Anna è andata a trovare Maria all’ospedale, lei le ha portato un mazzo di fiori.
   b. Quando Anna è andata a trovare Maria all’ospedale, \( \emptyset \) le ha portato un mazzo di fiori.
   “When Ana went to visit Mary at the hospital, she\( \emptyset \) gave her a bunch of flowers’.
   c. Quando Anna è andata a trovare Maria all’ospedale, lei era già fuori pericolo.
   d. Quando Anna è andata a trovare Maria all’ospedale, \( \emptyset \) era già fuori pericolo.
   “When Ana went to visit Mary at the hospital, she\( \emptyset \) was already out of danger’

Sp. a. Cuando Ana visitó a Maria en el hospital, ella le llevó un ramo de rosas.
   b. Cuando Ana visitó a Maria en el hospital, \( \emptyset \) le llevó un ramo de rosas.
   c. Cuando Ana visitó a Maria en el hospital, ella ya estaba fuera de peligro.
   d. Cuando Ana visitó a Maria en el hospital, \( \emptyset \) ya estaba fuera de peligro.

As revealed by the reading times for the second clause and by the answers to the comprehension questions, the results suggest that while in Italian there is a strict division of labour between NS and OSP (confirming Carminati’s findings), this division is not as clear-cut in Spanish. More precisely, while Italian personal pronouns signal a switch in subject reference, as shown by significantly faster RTs when they refer to an object antecedent (condition c. in the examples), the association between OSP and switch reference seems to be less reliable and significantly weaker in Spanish. The results are confirmed by a second pair of experiments, involving the same conditions, where the materials where presented phrase-
by-phrase. Significant cross-linguistic differences emerged for the RTs at the wrap up region, and in the accuracy and reaction times to the comprehension questions (example below).

(2) Ita.  a. Quando / Carlo / ha chiesto aiuto / a Diego / per preparare / l’esame / lui / lo ha superato / con voti / eccellenti.
b. Quando / Carlo / ha chiesto aiuto / a Diego / per preparare / l’esame / lo ha superato / con voti / eccellenti.
   ‘When Carlo asked Diego for help to prepare the exam, he passed it with excellent marks’.
c. Quando / Carlo / ha prestato aiuto / a Diego / per preparare / l’esame / lui / lo ha superato / con voti / eccellenti.
d. Quando / Carlo / ha prestato aiuto / a Diego / per preparare / l’esame / lo ha superato / con voti / eccellenti.
   ‘When Carlo provided Diego with help to prepare the exam, he passed it with excellent marks’

Sp.  a. Cuando / Carlos / pidió ayuda / a Diego / para preparar / el examen/ él / aprobó / con notas / excelentes.
b. Cuando / Carlos / pidió ayuda / a Diego / para preparar / el examen/ aprobó / con notas / excelentes.
c. Cuando / Carlos / ayudó / a Diego / a preparar / el examen/ él / aprobó / con notas / excelentes.
d. Cuando / Carlos / ayudó / a Diego / a preparar / el examen/ aprobó / con notas / excelentes.

The findings highlight for the first time an asymmetry between the strength of NS and OSP biases in Spanish that could not have emerged from the numerous studies carried out within the variationist tradition, based on corpus analysis (Enriquez, 1984; Cameron, 1992 among others), which could only produce evidence for the existence of a correlation between subject expression and switch in subject reference (robustly attested for several varieties of Spanish).

A subsequent pair of phrase-by-phrase self-paced reading experiments tested the hypothesis that the cross-linguistic differences attested might be related to the relative ambiguity of the Spanish verbal morphology compared to the Italian one with regard to the unambiguous expression of person features on the verbal head.
The results only provided weak support for the hypothesis, although they did confirm again the presence of the cross-linguistic differences in the processing and resolution of anaphoric NS and OSP dependencies revealed by the previous experiments.

References:
Unpublished PhD Dissertation.
Effects of Structure and Plausibility on the Comprehension of Pronouns in Spanish and English

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Research has been equivocal with regards to the effect of structure on pronoun resolution; experiments are not in agreement as to how a sentence like Sandra called Monica and Roger emailed her would be interpreted. Some studies have found that (non-subject) pronouns refer to the subject of the first sentence, Sandra (Crawley, Stevenson, & Kleinman, 1990), whereas others suggest that they refer to an entity in a previous sentence with an analogous grammatical role, here Monica (Chambers & Smyth, 1998). Chambers and Smyth in particular have been cited as evidence of structural priming (e.g., Badecker and Straub, 2002). It is still unclear why the results diverge. One possibility is that both sets of studies used experimenter intuition, rather than ratings, to control the plausibility of the potential referents, a practice that can be problematic (Wasow & Arnold, 2005).

Furthermore, it is still uncertain to what degree structural parallelism is restricted to languages resembling English, perhaps a by-product of the strong SVO pattern. To see whether this was in fact the case, we investigated Spanish, where the equivalent anaphor to an English object pronoun is a pre-verbal clitic. This permits a comparison of a language where anaphor is linearly parallel to its antecedent with one where it is not.

We created 29 auditory sentences in each language, testing 27 native speakers of English in Edmonton, Canada, and 38 native speakers of Spanish in Mexico City. To test for effects of plausibility, we created two conditions, an equiplausible condition where both potential antecedents were plausible, and a biased condition, where either the subject or object of the first sentence was strongly preferred. Sentences were selected based on discourse coherence, a measure empirically shown to affect plausibility (Wolf et al., 2004; Kehler et al. 2008). As our objective measure, we performed a materials test to control for plausibility by replacing the pronoun in the second clause with the names of the two characters from the first sentence, (e.g., Sandra called Monica. Roger emailed Monica) and asking participants to rate how plausible the second sentence was given the first (Table 1).

Table 1.
Item characteristics, from materials test.

<table>
<thead>
<tr>
<th>Language</th>
<th>Plausible antecedent</th>
<th>Sentence</th>
<th>Plausibility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name1 Name2</td>
<td></td>
<td>Name1 Name2</td>
</tr>
<tr>
<td>English</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equiplausible</td>
<td>Subject/Object</td>
<td>Sandra called Monica, and Roger emailed her</td>
<td>4.9 (0.1) 5.5 (0.1)</td>
</tr>
<tr>
<td>Biased</td>
<td>Subject</td>
<td>Michelle trained Beth, and Anne paid her.</td>
<td>6.4 (0.1) 3.0 (0.3)</td>
</tr>
<tr>
<td></td>
<td>Object</td>
<td>Robert registered Joe, and John taught him.</td>
<td>3.1 (0.3) 5.7 (0.1)</td>
</tr>
<tr>
<td>Spanish</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equiplausible</td>
<td>Subject/Object</td>
<td>Sandra llamó a Mónica y Rogelio la citó.</td>
<td>4.6 (0.2) 5.2 (0.2)</td>
</tr>
<tr>
<td>Biased</td>
<td>Subject</td>
<td>Michelle entrenó a Bertha y Ana María le pagó.</td>
<td>6.3 (0.2) 3.7 (0.3)</td>
</tr>
<tr>
<td></td>
<td>Object</td>
<td>Roberto registró a José y Gustavo le enseñó.</td>
<td>4.1 (0.3) 6.0 (0.2)</td>
</tr>
</tbody>
</table>

Mean (Standard error). Plausibility was rated on a 7 point scale, where 7 was most plausible, and 1 was most implausible.

Antecedent preference was then measured by presenting the sentences with a question Who did Frank email? Participants indicated their answers using a scale from 3 (certain that it is
Sandra), -3 (certain that it is Monica), (Figure 1). In the equiplausible condition, participant responses are very strongly in line with the predictions of structural parallelism. Biased pronouns were found to refer to the referent that was judged most plausible (Figure 2).

<table>
<thead>
<tr>
<th>Question</th>
<th>Sandra</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
<th>-1</th>
<th>-2</th>
<th>-3</th>
<th>Monica</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Who did Roger email?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Participants would indicate their preference by circling 3 or -3 if they strongly favoured one character, if they were completely uncertain, they would circle 0.

![Figure 1](image1.png)

Figure 2. Antecedent preference from English and Spanish experiments. Positive numbers represent preference for the subject, negative numbers for the object. Biased stimuli resolved in the direction of the bias, whereas equiplausible pronouns resolved toward the parallel function, object.

The results suggest that when both referents are roughly equiplausible, the pronoun will refer to the entity with the same grammatical role. However, when there is a bias, that bias washes out the effects of structural parallelism. With regard to the issue of whether parallelism is specific to languages with strong SVO structures, the pattern observed in English and Spanish results was effectively identical, in spite of clear cross-linguistic difference in structures.

References:
Speakers routinely use more salient referring expressions when referring to less active antecedents (Venditti et al., 2001). In English, a common strategy for referring to a less active, but nonetheless given referent, is to use a pronoun with a pitch accent; as in *Sandra called Monica, and Roger emailed her/HER*. The alternation suggests that use of an accent switches the referent from the most active referent to a less active referent; in this example *her = Monica, but HER = Sandra* (Venditti et al., 2001). However, accenting may not have this effect in all languages. The Spanish analog of an English unstressed pronoun is a pre-verbal clitic, such as *la*. Prominence is increased by including an explicit post-verbal pronoun as well, which doesn’t have to be accented (*a ella* in the example *Sandra llamó a Monica y Rogelio le escribió (a ella)*: Blackwell, 2001; Baauw et al. 2011).

It appears that speakers of different languages have different strategies at their disposal to make the referring expression more salient. But do listeners in those languages also take advantage of them, by switching to a structurally less active referent or a semantically less active referent when hearing a more salient pronoun? The pronouns in the sentences above resolve according to grammatical role parallelism (Smyth, 1994). If grammatical role parallelism determines activation, then a more salient referring expression should switch the referent to a less active grammatical role (above, the subject *Sandra*). It’s also been suggested that semantics determine activation (Kehler et al., 2008). Following this approach when a referent is more semantically plausible, a more salient referring expression should switch to a less plausible referent. We created two conditions: equiplausible, like the examples above where both *Sandra* and *Monica* were plausible, and biased, for example *Robert registered Joe, and John taught him*, where *Joe* is more plausible than *Robert* as antecedent (plausibility ratings in Table 1).

### Table 1. Item characteristics, as derived from materials test.

<table>
<thead>
<tr>
<th>Language</th>
<th>Condition</th>
<th>Sentence</th>
<th>Plausibility</th>
<th>Subject</th>
<th>Object</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>Equiplausible</td>
<td><em>Sandra called Monica, and Roger emailed her</em></td>
<td>4.9 (0.1)</td>
<td>5.5 (0.1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biased</td>
<td><em>Robert registered Joe, and John taught him</em></td>
<td>3.1 (0.3)</td>
<td>5.7 (0.1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plausible antecedent</td>
<td><em>Sandra llamó a Mónica, y Rogelio le escribió</em></td>
<td>4.6 (0.2)</td>
<td>5.2 (0.2)</td>
<td></td>
</tr>
<tr>
<td>Spanish</td>
<td>Equiplausible</td>
<td><em>Roberto registró a José, y Gustavo le enseñó</em></td>
<td>4.1 (0.3)</td>
<td>6.0 (0.2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biased</td>
<td><em>Sandra llamó a Mónica, and Roger emailed her</em></td>
<td>4.9 (0.1)</td>
<td>5.5 (0.1)</td>
<td></td>
</tr>
</tbody>
</table>

Mean (Standard error). The plausibility was rated on a seven-point scale. The central value is 4.

We tested native speakers of English (27) and Mexican Spanish (37). In English, prominence was manipulated by contrasting unaccented Pronouns (Pr), with Accented Pronouns (AccPr). In Spanish we compared the least prominent reference form, a Clitic (Cl), and two more...
salient conditions, sentences with a Clitic and a Pronoun, Cl+Pr, and sentences with a Clitic and an Accented Pronoun (Cl+AccPr). After hearing a sentence, participants indicated the referent preference by answering a question (Who did Steve email?) on a seven-point scale from "subject 3" (= Sandra) to "object 3" (= Monica) (Figure 1).

<table>
<thead>
<tr>
<th>Question</th>
<th>Sandra</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Monica</th>
</tr>
</thead>
</table>

Figure 1. Participants indicated their preference by circling 3 or -3 if they strongly favored one character, if they were completely uncertain, they would circle 0. Left option Sandra is subject, the right option Monica is object of the first sentence.

The results show that when more salient forms were used, the default object preference decreased. This pattern was stronger in equibiased sentences, and resulted in a change of referents. In biased sentences, more salient forms resulted only in a decrease in preference for the object, but did not switch the referent. The degree of switch was equivalent in both languages (Figure 2), suggesting that salience markers are used similarly. Accenting did not give any clear extra change in preference in Spanish, suggesting that accentuation is not always used the same way crosslinguistically.

Figure 2. Antecedent preference for Biased and Equi plausible sentences with standard errors. The equiplausible sentences (■) switched referents when more salient forms were used, whereas biased sentences (X) did not.

References:
Are listener’s sensitive to articulation differences in over-described referring expressions: A test of the Audience Design Hypothesis?

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Introduction: Several studies have shown that speakers will often include unnecessary modifiers when producing referential expressions, contrary to the second part of the Maxim of Quantity [1,2]. Other studies have found that listeners are slower to process and execute descriptions that contain extra information [e.g. 3]. At first glance, the asymmetry between these findings suggests that speakers do not adhere to the Audience Design Hypothesis, which predicts that speakers should formulate utterances to be cooperative with their interlocutors [4]. We hypothesized that the phonetic properties of unnecessary modifiers might suggest that they are less prominent than modifiers required for referent identification. To test this hypothesis, we conducted two experiments to investigate this potential dissociation between production and comprehension.

Experiment 1: The first experiment was a production study that required speakers to produce a referential expression (e.g. the large triangle) that identified an object from an array of distracters. We compared the acoustic properties (duration, pitch, and intensity) of modifiers that distinguished two contrasting objects (e.g. a small and a large triangle) with modifiers that were not used to distinguish contrasting objects. Participants were presented with four objects arranged in a 2 x 2 array. After 1500ms, a small arrow appeared in one of the four quadrants indicating which object participants had to describe. Instructions indicated that participants had to produce enough information for unique identification, but said nothing about including extra information. Results showed that over-described modifiers were significantly shorter in duration $t(13) = 3.58, p < .01$ compared to those that were used to distinguish contrasting objects (282ms versus 355ms). There were no differences in pitch or intensity.

Experiment 2: The second experiment used the utterances produced in Experiment 1, and the goal was to determine whether comprehension performance was affected by modifier length. If speakers use length to signal (non)contrastiveness, then we expected comprehension of over-descriptions to be more efficient when a modifier was short compared to long. Participants heard utterances such as Click on the large triangle, and at utterance offset, a 2 x 2 array of objects appeared. For the critical trials, there was, for example, only one triangle in the array. Two other quadrants contained contrasting objects (e.g. a large square and a small square). Participants used the mouse to click on the indicated object. Results showed that reaction times from display onset were significantly shorter $t(25) = 2.13, p < .05$ with the modifiers that were short in duration compared to those that were long (953ms vs. 998ms).

Conclusions: On the production side, our findings suggest qualitative differences between over-described modifiers and modifiers that are uttered in contexts where they are needed. Thus, it appears that speakers’ utterances reflect referential contrasts. Results from the comprehension experiment supported speakers' adherence to the Audience Design Hypothesis, as we were able to confirm that listeners are in fact sensitive to durational differences. These results may partly explain why speakers so often include unnecessary information in their utterances.
References


Ambiguous pronoun resolution has mainly been studied so far in languages with only overt and no zero pronouns. In these studies, it has been found that pronoun resolution is influenced by a complex interplay of different factors, including syntactic role, order of mention and information structure (e.g., Arnold & al., 2000; Kaiser & Trueswell, 2008). By contrast, very little is known about the question of which types of factors influence the resolution of zero anaphora in languages in which these are common. Available studies on the online resolution of zero (subject) anaphora in Italian (Carminati, 2005) and Chinese (Yang et al., 1999) found a strong preference for zero anaphora to refer to antecedents in subject position. Similarly, in an offline questionnaire study, Alonso-Ovalle et al. (2002) observed that zero anaphora in Spanish were preferentially interpreted as referring to subject antecedents. The same tendency was observed for overt pronouns, but to a lesser degree.

Together, these results are compatible with the idea that at least in richly inflecting languages such as Italian, Spanish and Turkish, the resolution of zero anaphora is determined mainly by syntactic factors (Carminati, 2005). This would stand in contrast to the results for overt pronouns showing the influence of multiple types of factors. Non-syntactic factors, however, might influence the resolution of zero anaphora as well, but this type of factors has not been investigated in the studies on zero anaphora available so far. In the current study, we made a first attempt to fill this gap by testing the influence of (explicitly) topicalising or focusing the syntactic subject on the resolution of zero anaphora in Turkish. Topicalisation was achieved by separating the first-mentioned referent with a comma from the rest of the sentence, and focusing by placing the subject referent in second position, which has been shown to be a focus position in Turkish (Ergüvanli, 1984). We tested these conditions in a written questionnaire with 24 experimental sentences interspersed with 40 fillers. 64 native speakers of Turkish completed the questionnaire, by filling a gap in a sentence following the critical sentence (e.g., “____ worked in Rome” for the example below). We tested the four conditions described in (1)-(4) with their respective choice of subject antecedents in percentages.

(1) Subject sentence-initial and topic by default:
Ergin Latif’ı Roma’da çalıṣtığı zaman bıçakladı. (56%)
Ergin-NOM Latif-ACC Roma-LOC worked when stabbed
Ergin stabbed Latif when he worked in Rome.

(2) Subject sentence-initial and explicitly topicalised:
Ergin, Latif’ı Roma’da çalıṣtığı zaman bıçakladı. (58%)
Ergin-NOM, Latif-ACC Roma-LOC worked when stabbed

(3) Subject in focus position, object topic by default:
Latif’i Ergin Roma’da çalıṣtığı zaman bıçakladı. (70%)
Latif-ACC Ergin-NOM Roma-LOC worked when stabbed

(4) Subject in focus position, object explicitly topicalised:
Latif’ı, Ergin Roma’da çalıṣtığı zaman bıçakladı. (67%)
Latif-ACC, Ergin-NOM Roma-LOC worked when stabbed.

We found on average 57 % of subject-interpretations in (1) and (2), and 68.5 % in (3) and (4), showing that, in line with previous findings (Alonso-Ovalle et al., 1999; Carminati, 2005;
Yang et al., 1999), comprehenders globally preferred subject over object antecedents for zero pronouns ($t_1(63) = 5.44, p > .01; t_2(23) = 8.49, p < .0001$). However, the subject was preferred even stronger when it was in focus position ($F_1(1,60) = 7.71, p < .01; F_2(1,20) = 17.58, p < .0001$). No systematic influence of topicalisation was established (all Fs < 1). This is to our knowledge the first piece of evidence suggesting that pragmatic factors can influence the resolution of zero anaphora on top of syntactic factors.

References:
Processing cataphoric pronouns in Dutch: an ERP study
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The processing of cataphoric pronouns has been shown to follow the same mechanisms as the processing of wh-dependencies in that the parser actively searches for an antecedent to interpret the pronoun within the sentence, except in those cases where the pronoun must obey principle C of the binding theory and cannot be c-commanded by the antecedent [1]. This is the case for the Gender Mismatch (GMM) effect, named after a slowdown effect that shows that the parser tries to link an antecedent to a preceding pronoun only when a pronoun can be bound by it [2,3]. Most of the studies that tested whether there is an active search triggered for an antecedent after encountering cataphoric pronouns used behavioral techniques such as self-paced reading or eye-tracking [4,5] and only a few used the EEG technique [6].

The current study on Dutch uses ERPs to examine the processing of sentences with cataphoric pronouns as the parser looks for an antecedent in the upcoming input. If the parser attempts to bind the pronouns *zijn* and *haar* in (1a) and (1b) to the masculine antecedent *Lodewijk*, we expect a GMM effect at the position of the potential antecedent in (1b). On the other hand, if the parser respects Principle C of the binding theory in (1c) and (1d), we do not expect to find any ERP difference at the position of the potential antecedent *Lodewijk* showing that no link has tried to be made between the pronouns *hij* and *zij* and the antecedent. Additional proper nouns were included to guarantee that all pronouns had an antecedent in the sentence.

We conducted an ERP experiment where EEG was continuously recorded while native speakers (n=24) of Dutch read silently 36 sentences such as (1a-d) interspersed with 35 fillers and subsequently answered a comprehension question for every sentence. Results show that there is a central anterior negativity in the 200-600ms window (N400) [7,8] in (1b) condition with respect to (1a) at the point of the potential antecedent *Lodewijk* (significant 3-way interaction between factors Condition, Hemisphere (left, Right, Central) and electrode position (Anterior, Middle, Posterior); F(12,276)=2.05, p=0.045). Comparison between conditions (1c) and (1d) yielded no significant difference in the ERP waveforms.

The central anterior negativity generated at the antecedent *Lodewijk* for (1b) condition suggests that the parser attempts to link the antecedent to the preceding pronoun *haar* and fails to interpret it at the antecedent due to the gender mismatch between the pronoun -marked for feminine gender - and the antecedent *Lodewijk* – a name in masculine gender. The same effect is absent in the other conditions, which shows that the parser does not try to link the antecedent with the preceding pronoun in (1c) and (1d) so that principle C is respected. Overall results confirm the active search mechanism for an antecedent started whenever there is a pronoun that must be bound in the local context. We discuss implications of these results in light of the accumulated knowledge on long-distance dependency processing.
Experimental items:
No constraint
1a. Zijn assistenten kwamen erachter dat Lodewijk Boer geen prijswinnaar geselecteerd had, maar Mirjam had geen interesse in de roddel.
Selected had but Mirjam had no interest in the gossip.

No constraint
1b. Haar assistenten kwamen erachter dat Lodewijk Boer geen prijswinnaar selected had, but Mirjam had no interest in the gossip.

Principle C
1c. Hij kwam erachter dat Lodewijk Boer geen prijswinnaar selected had, but Thomas had no interest in the gossip.

Principle C
1d. Zij kwam erachter dat Lodewijk Boer geen prijswinnaar selected had, but Mirjam had no interest in the gossip.

References:
It’s all in how you say it: Predictability effects on referring expressions
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Recent findings suggest that language processing is sensitive to predictability (Bell et al., 2003; Hale, 2001; Hume & Mailhot to appear, Jurafsky et al. 2001, Levy, 2008). We investigated predictability in reference-tracking, focusing on how an entity is referred to and how likely it is to be mentioned. Currently, the role of predictability in reference-tracking is controversial: Some claim that predictability (likelihood-of-mention) is connected to referring-expression choice: Reduced forms (e.g. pronouns) are used for highly-predictable referents (Arnold, 2008; Givón, 1989). However, others (e.g. Fukumura & van Gompel, 2010) claim likelihood-of-mention is separate from choice of referring expression (see Kehler et al., 2008; Kaiser, 2010 for related work). To explore this, we investigated effects of likelihood-of-mention (i) on the choice of expressions and (ii) the acoustic duration of referring expressions.

In Exp1 (Prompt-pronoun), participants (n=24) heard sentences with agent-patient verbs while viewing scenes (see sample image). The study contained 4 male, 4 female characters. The task was to produce a continuation sentence. The prompt sentences were active or passive, and ended in a pronoun (ex.1). For consistency, we used the ‘as a result’ connective, which is known to focus the patient argument. Exp2 (No prompt-pronoun) was the same, but sentences did not end with a pronoun (24 new participants).1 In Exp1, coders noted what the prompt-pronoun referred to. In Exp2, coders noted the referring expression chosen and its referent. Durations of these expressions were recorded.

Results/Referring expressions: In Exp1, participants mostly interpreted the pronoun as referring to the character that is the patient in the preceding sentence, i.e., the object in actives and the subject in passives (p’s<.05).

In Exp2, when participants produced pronouns (approx.11% of trials), we again see a patient-preference (>60% patient-continuations). However, when we look more broadly at which referent participants are most likely to continue with in Exp2, independent of the referring expression that is used, we see that the patient is not consistently the entity with the highest likelihood-of-mention. In active-voice conditions, overall we find that most continuations (collapsing pronoun-initial and name-initial continuations) do indeed start with the preceding object/patient (p’s<.01). However, in passive-voice conditions, these continuations were split

1 Exp1 and 2 also included ambiguous then connectives (temporal/causal). Preliminary analyses suggest that when used causally, then resembles as a result. However, due to then’s ambiguity and the resulting unbalanced data points, we focus here on as a result.
between the patient (the subject) and the agent in the by-phrase (no significant differences)—both have a comparable likelihood-of-mention. In other words, in passives, the patient and the agent are equally predictable.

Put together, the pronoun-initial and non-pronoun-initial continuations in Exp2 reveal a dissociation between likelihood-of-mention and likelihood-of-pronominalization. More specifically, the connection between pronominalization and the patient thematic role does not extend to likelihood-of-mention: Though actives show a bias for patient-initial continuations, in passives the presence of the agent in the by-phrase results in a boost in the overall likelihood of agent-initial continuations. (We have conducted other studies showing these results cannot be reduced to recency. We suggest they stem from the clash that arises when semantically-prominent arguments – agents – are placed in the low-prominence by-phrase, see Kaiser, Holsinger & Li, 2011).

Results/Acoustic duration: Given the dissociation between likelihood-of-mention and likelihood-of-pronominalization, does this mean predictability plays no role in reference-tracking? We also looked at the duration of names that participants produced in subject position (e.g. the second occurrence of ‘Lisa’ in Mary slapped Lisa at the zoo. As a result Lisa stormed off angrily). We compared names produced in the active condition, where the object of the prompt-sentence has a high likelihood of subsequent mention (i.e. it’s the expected referent), and names produced in the passive condition, where there is no clearly expected referent, since continuations were split between subject and object. Analyses of duration show that names in subject position are shorter (283ms) after active sentences than names in subject position (320ms) after passive sentences (p<.03 by items, p=.0858 by subjects). Thus, the duration of the names showed effects of how predictable the referent was.

Conclusions: Effects of likelihood-of-mention/predictability do exist in the domain of reference-tracking, in the form of acoustic reduction, although they do not appear to influence referring-expression choice. This work highlights the importance of exploring both lexical and acoustic aspects of referential production.

References:
Jurafsky et al. (2001). Probabilistic relations between words. In Frequency and the emergence of linguistic structure.
Repetition reduction: Repeated forms versus repeated referents
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Repeated words are produced with reduced prominence compared to words that are new to a discourse. Lam & Watson (2010) argue that this effect is due to priming in the production system; however, the locus of the repetition effect remains unresolved. Repetition reduction could be due to repetition at the message level, such as repeated mention of a referent, or repetition at the word level, such as repetition of words.

In this study, we explore the repetition effect by testing whether repetition reduction is due to repeated mention of a referent, independent of the form of the referring expression, or due to repetition of a referential form, independent of the intended referent.

Participants were asked to describe two events involving characters depicted on a computer display. Participants were told that they would be describing people moving between training centers for various occupations. Occupations were indicated by the character’s uniforms. The participant described the events by saying “the occupation is leaving A … the occupation is leaving B.” The critical word is the occupation in the second leaving event. Each job was used as the target of the second event exactly twice during over the course of the experiment.

We manipulated two factors: Repeated mention of the person and repeated mention of the job name (See Example 1). If repetition reduction arises from repetition of the referent regardless of the referring expression used, then repetition of a referent should lead reduction even when the occupation has changed. If repetition reduction is due to repetition of the referring expression, then any repetition of the occupation name should lead to reduction, even when the referent has changed.

The data were analyzed using linear mixed effects regression. We report results for intensity and duration. Duration showed an effect of repeating the name (p<0.01), but no effect of repeating the referent. There was no significant interaction between referent repetition and referring expression repetition. Similarly, for intensity, there was only an effect of repetition of the name. Repeated names had lower intensity than non-repeated names (p<0.01). Again there was no interaction between name and referent repetition.

In summary, both the intensity and duration data suggest that repeated forms, not repeated referents are what lead to reduction in prominence. This suggests that reduction is due to word level repetition.

Example 1.
Different people, different job: “The doctor is leaving A. The detective is leaving B.”
Different people, same job: “The detective is leaving A. The detective is leaving B.”
Same person, different job: “The doctor is leaving A. The detective is leaving B.”
Same person, same job: “The detective is leaving A. The detective is leaving B.”

References:
Word burstiness improves models of word reduction in spontaneous speech

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Speakers tend to reduce words when they are predictable (e.g., Aylett & Turk, 2004). Bell et al. (2009) found that givenness and local word predictability, which are both factors in overall predictability, independently affect word durations. Furthermore, they found that these factors differentially affect function and content words. Here, we offer a unified model that captures the differential effects of givenness across word class with new findings on more fine-grained differences in the effects of givenness within word classes.

We build on results in the field of document retrieval concerning the characteristic distributions of words across texts and their predictabilities within texts (c.f. Church & Gale, 1995). Controlling for word frequency, words that are topical tend to be highly bursty. They occur repeatedly over short spans, with long gaps between bursts. Less topical words are more randomly disseminated and are accordingly less bursty. As a result, the contextualized likelihood of any specific word when discourse-new is lower if it is more bursty than if it is less bursty. Once a word becomes discourse-old, highly bursty words are more likely to occur again soon than less-bursty words, whose likelihoods change little. Heller, Pierrehumbert, and Rapp (2010) reported that burstiness-related differences in word occurrence likelihood improved the prediction of eye-fixation patterns during reading of extended texts.

The current project examines how burstiness influences word durations during spontaneous speech production. Highly bursty words should have longer durations than less bursty words when they are discourse-new. Once they are discourse-old, highly bursty words become more predictable than comparable discourse-old less bursty words, and should therefore exhibit a greater reduction in duration. This should result in an interaction of givenness and burstiness. Because content words are more likely than function words to be highly bursty, the confirmation of these predictions could also account for the previously noted overall differences in the effects of givenness across word classes.

Linear mixed-effects regression models were fit to log-normalized word duration data from 40 speakers in the Buckeye Corpus of Conversational Speech (Pitt et al., 2007). 151,895 word tokens, representing 3,936 word types, were analyzed. Burstiness was quantified using the dissemination measure developed in Altmann, Pierrehumbert, and Motter (2011). The addition of burstiness and its interaction with givenness to a model of word duration significantly improved model fit beyond a model including only control factors (e.g., word frequency, word class, bigram probabilities, givenness, etc.). This improvement remained significant within function and content word subsets. The most bursty words were 31ms longer than the least bursty words. Discourse-old highly bursty words were more reduced with respect to their discourse-new durations than less bursty words. When these factors were included, the interaction of givenness and word class was not significant.

Thus, a regression model of durations in speech production was improved by including discourse information indexed by word burstiness. These results extend models of predictability effects in speech production to time-scales beyond the sentence, and also account for previously noted differences in the effect of givenness across word class.
References:
**Phrase frequency effects in language production**

Which principles govern the organization of the mental lexicon? The words and rules view assumes that storage is governed by linguistic rules, which ensure that only morphologically simple forms are stored in the lexicon (e.g., Pinker, 1994). An alternative view is that probabilistic principles govern storage, and that storage is not only reserved for morphologically simple forms (e.g., Elman, 2009). These two hypotheses differ in their assumptions about the storage of multi-word phrases. The words and rules hypothesis assumes that multi-word phrases whose meaning is transparent (e.g., red car) are not stored, but are generated on-line from the stored morphologically simple forms (e.g., red, car). By contrast, the probabilistic hypothesis assumes that sufficient exposure and practice with token multi-word phrases leads to their permanent storage in the lexicon. Here we attempted to distinguish between these two hypotheses by evaluating the impact of the variable phrase frequency on the production of multi-word phrases. Our logic was that the frequency effect indicates whether a linguistic form is stored.

In Experiment 1, twenty-six native Spanish speakers produced noun + adjective and noun + noun phrases in response to depicted colored objects and two superimposed objects (see Figure 1). Phrase frequency and object name frequency were obtained from Google. Phrase type was manipulated to examine whether phrase frequency effects were more pronounced in phrase types that are more frequent (noun + adjective > noun + noun). Naming latencies were analyzed using mixed-effect regression models with token phrase frequency, object name frequency, phrase type, and trial (the ordinal position of a response in the experiment) as fixed-effect predictors. Collinearity between frequency variables was taken into account.

Experiment 1 (see Table 1) revealed effects of trial, phrase type, and phrase frequency in the noun + adjective phrases. Object name frequency did not predict latencies.

Experiment 2 served to generalize the results of Experiment 1 with forty-four French speakers that produced determiner + noun + adjective and noun + adjective phrases in response to colored objects. Noun + noun phrases were not investigated since they yielded no phrase frequency effects in Experiment 1. As before (see Table 2), there were effects of trial, phrase type, and phrase frequency in both phrase types, and no effect of object name frequency.

These data present, to our knowledge, the first observation of a phrase frequency effect in the production of language, and agree with results recently obtained in the field of language comprehension (Arnon & Snider, 2010; Reali & Christiansen, 2007; Siyanova-Chanturia, Conklin, & Van Heuven, 2011). These data suggest that multi-word phrases up to three words whose meaning is transparent are stored as holistic chunks in the lexicon (Bybee & Scheibman, 1999). This conclusion is inconsistent with the words and rules view (Pinker, 1994), and with current models of language production that adhere to this view (e.g., Dell, 1986; Levelt, 1989). By contrast, these results fit with a view of the mental lexicon in which general statistical learning mechanisms determine lexical storage (e.g., Elman, 2009).

**References**

Figure 1. Example stimuli from Experiment 1 and 2. The colored object on the left was named as a noun + adjective phrase “casa naranja” [orange house] in Experiment 1, and as a noun + adjective phrase “maison orange” [orange house], or as a determiner + noun + adjective phrase “la maison orange” [the orange house] in Experiment 2. The two superimposed objects on the right were named as a noun + noun phrase “casa volcán” [house volcano] in Experiment 1.

Table 1. Regression coefficients (β) with corresponding t and p values for each of the fixed effect predictors in the regression analyses of Experiment 1. Standard error of the regression coefficient between brackets. Degrees of Freedom associated with the t values between brackets. P values were calculated from Markov chain Monte Carlo confidence intervals using the posterior distribution of the independent variables (Baayen, 2008).

<table>
<thead>
<tr>
<th>Predictors</th>
<th>β (std. error)</th>
<th>t (2357)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>6.6285 (.1177)</td>
<td>56.28</td>
<td>.0000</td>
</tr>
<tr>
<td>Trial</td>
<td>-.0004 (.0001)</td>
<td>-3.40</td>
<td>.0007</td>
</tr>
<tr>
<td>PT&lt;sub&gt;NN&lt;/sub&gt;</td>
<td>.3162 (.0784)</td>
<td>4.03</td>
<td>.0001</td>
</tr>
<tr>
<td>Object freq&lt;sub&gt;NA&lt;/sub&gt;</td>
<td>.0045 (.0069)</td>
<td>.65</td>
<td>.4888</td>
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<tr>
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<td>-.0131 (.0046)</td>
<td>-2.82</td>
<td>.0022</td>
</tr>
<tr>
<td>PT * Object freq</td>
<td>-.0128 (.0046)</td>
<td>-2.75</td>
<td>.0078</td>
</tr>
<tr>
<td>PT * Phrase freq</td>
<td>.0098 (.0051)</td>
<td>1.93</td>
<td>.0572</td>
</tr>
</tbody>
</table>

Note. PT = Phrase Type; NN = noun + noun; NA = noun + adjective; freq = frequency.

Table 2. Regression coefficients (β) with corresponding t and p values for each of the fixed effect predictors in the regression analyses of Experiment 2.

<table>
<thead>
<tr>
<th>Predictors</th>
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<th>p</th>
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<tr>
<td>(Intercept)</td>
<td>6.4904 (.1102)</td>
<td>58.86</td>
<td>.0001</td>
</tr>
<tr>
<td>Trial</td>
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<td>.0050</td>
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<tr>
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<td>.6280</td>
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<tr>
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<td>-.0031 (.0016)</td>
<td>-1.97</td>
<td>.0456</td>
</tr>
<tr>
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<td>-.0093 (.0037)</td>
<td>-2.51</td>
<td>.0124</td>
</tr>
<tr>
<td>PT * Phrase freq</td>
<td>.0015 (.0015)</td>
<td>1</td>
<td>.3182</td>
</tr>
</tbody>
</table>

Note. PT = Phrase Type; NA = noun + adjective; DNA = determiner + noun + adjective; freq = frequency.
Alignment in rate of speech: Evidence from a corpus of dialogue
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It has long been known that conversational partners tend to re-use each others’ syntactic structures, referring expressions, and words, aligning on common ways of talking about the world (see Pickering & Garrod, 2004). There is increasing evidence that alignment extends beyond what is said to encompass the manner in which it is said. For example, Junger and Hupp (2009) show that the rate of speech in monologues can be primed; and Street (1984) shows convergence of a variety of prosodic features.

In this paper, we investigate whether articulation rate aligns in natural dialogue, by analysing dialogues transcribed from the Map Task Corpus (Anderson et al., 1991). By establishing the articulation rate in syllables per second of each dialogue turn across 128 dialogues between 64 participants, we were able to test whether speakers tended to converge on a common articulation rate over the duration of the dialogue, and whether the articulation rate of a given dialogue turn could be predicted by that of the interlocutor’s preceding dialogue turn. Our analyses controlled for each member of the conversation’s experience both with the map being discussed and the task in general; as well as the length in words of both their own and their partner’s turn.

Our analyses show that the absolute differences between interlocutors’ articulation rates decreased consistently across the lengths of the dialogues they were engaged in, showing that the speed at which interlocutors spoke converged as each dialogue progressed. Moreover, speakers’ articulation rates were related to their interlocutors’ articulation rates in the previous dialogue turn, suggesting that the mechanism by which dialogue rates converged appeared to be local priming, similar to that found for syntactic structures (e.g., Bock, 1986). Since each speaker in the Map Task interacted with three different speakers, our findings appear to generalise well as a general property of dialogue.

Taken as a whole, our findings provide clear evidence that partners in conversation are primed by each other’s articulation rates. Across the course of the conversation, the consequence of this continued priming is that partners’ rates of speech tend to converge. This process of priming and convergence provides strong support for the idea that, when engaged in conversation, speakers align on more than just the content of what is being said.

References
Naming is inhibited by the belief that one’s partner is also naming
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When two people share a task, they represent their partner’s task alongside their own (Sebanz et al., 2006). Representations of one’s own and the partner’s actions recruit the same mechanisms (e.g., Hamilton et al., 2004), in ways that affect each other. Feedback from the partner’s actions is not necessary, as knowledge about her expected response suffices to activate a representation of her task (Vlainic et al., 2010).

It is not known whether another’s to-be-uttered words are represented in a similar way as one’s own words. We investigated whether picture naming latencies are affected by knowledge of a partner’s concurrent task. Fifty pictures were presented in pairs (SOA = 0 ms). As in Damian and Bowers (2003), the smaller picture was embedded into the larger one. Before each trial, participants (N = 24, tested in pairs) saw their names on the screen, each followed by the words “red”, “blue”, or “no”. They responded to colour words by naming the picture presented in that colour and to “no” by remaining silent. We varied whether their partner named the same picture (SAME), the other (distractor) picture (DIFFERENT) or no picture (NO). We also manipulated whether distractor pictures were semantically related (e.g., apple – banana) or unrelated (e.g., apple – blouse) to the target picture. Both manipulations were within-items and within-participants. Most studies found no effect from semantically related distractor pictures (e.g., Damian & Bowers, 2003). However, if one’s partner task is represented, participants might pay more attention to the picture their partner is going to name. If so, we expect a semantic interference effect in the DIFFERENT condition. Participants were tested in two soundproof rooms separated by a window. They could not hear each other. Thus, we ruled out the possibility that the partner’s naming speed could affect responses.

Participants took longer in the SAME (694 ms) than in the NO (682 ms) condition, and showed a trend toward slower naming in the SAME than in the DIFFERENT (688 ms) condition. These results demonstrate interference from the belief that the partner is naming. This might be due to either representing the partner’s process of naming in general or to the specific process of naming the same word as the participant. Interestingly, these effects occurred primarily when participants were naming the large rather than small pictures. In addition, we found a semantic interference effect, which was limited to the small pictures (unrelated: 688 ms vs. related: 706 ms). It did not interact with partner’s task suggesting that its source is not a modulation of attention induced by knowledge of what the partner is doing.

We propose that speakers predict the behaviour of their partners in a shared language task using the same mechanisms they use to represent their own utterances. They experience inhibition in the SAME condition, presumably because of confusion about whether aspects of the production system are “tagged” for speaking or predicting one’s partner’s speech. We are conducting a follow-up experiment using degraded pictures; speakers should believe that their partner’s task is more difficult as well as their own.

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Production of number agreement in adverse conditions

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Humans speak under all sorts of different circumstances, and certainly not always against the silent background usually found in laboratory environments. A more naturalistic setting would involve a certain level of noise, for instance the kind of noise created by other speakers in the same room. While background noise has been shown earlier to affect the phonetic level, leading to higher articulation effort, so far very little is known about the effects of noise on other levels of linguistic structure during processing-for-production.

Our study tested the effect of external distracter noise on the generation of subject-verb agreement in spoken language, by eliciting agreement errors. We modelled noisy environments with three speech-free sounds that differed in the amount of intensity fluctuation (“babble” characteristics) contained in the sound signal, one temporally unmodulated sound and two sounds with different broad-scale intensity fluctuation across time. In the experiment 24 subjects repeated and completed visually presented NP-PP-V sentence fragments which contained a head noun and a local noun inside the PP, both marked for number. There could be either a match or a mismatch between the number marking on both nouns (see example sentences). Subjects spoke against a current of noise with a mean intensity of 65 dB SPL.

In silence and unmodulated (or constant) noise we replicated agreement attraction effects, more specifically a plural mismatch effect, where a plural local noun attracts agreement away from a singular marked head noun. Crucially, under modulated noise the error patterns changed, and the amount of errors increased in all cases where the head noun of the preamble was marked for plural. The results show that noise, viz. non-linguistic data, can influence the grammatical encoding stage of sentence formulation, depending on acoustic characteristics of the noise.

Our interpretation is that low-level auditory processing creates a secondary task load which exerts an influence on the grammatical encoding stage. The additional load leads to a competition for processing resources, e. g. time, and ensuing difficulty to (re-)access the correct number information of the head noun when trying to retrieve an inflected verb form. Subjects overcome this difficulty by resorting to the ‘default’ singular inflection of the verb. We suggest that the effect of noise we observed can be explained on the basis of a model for the irrelevant sound effect, as a competition for processing time on a mechanism shared between more peripheral auditory processing steps and grammatical encoding.
Example sentences
"The inscription on the ancient pillar is weathered."
"The inscriptions on the ancient pillars are weathered."
"The inscription on the ancient pillar is weathered."
"The inscriptions on the ancient pillar are weathered."

Results
Prosodic properties of contrastive information in spontaneous productions

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Speakers frequently use pitch accents (localized pitch prominence assigned at the phrasal level) to express the contrastive status of words (cf. Pierrehumbert & Hirshberg, 1986; Krahmer & Swerts, 2001; Watson, Tanenhaus & Gunlogson, 2008). In spontaneous dialogue, the phonetic realization of pitch accent depends on multiple factors, including overall pitch range, utterance length and rhythmic structure, the location of the accented word within phrasal and discourse structures, and individual differences in speech style. The relationship between the physical properties of pitch accents and their phonological, semantic and pragmatic representations is difficult to observe in laboratory experiments, where artificial tasks often restrict and may even alter the development of discourse context. In this study, we examined the prosodic properties of contrastive referential expressions elicited in an interactive conversational task. Participants gave instructions on how to decorate holiday trees with a given set of ornaments, where the sequence and location of ornaments were prompted via photographs displayed on a computer screen. No speaking instructions or example utterances were provided. This method loosely constrained the discourse structure of the dialogue as well as the range of referential expressions produced by speakers, facilitating the examination of turn taking and the potential contrastive intent behind each utterance.

Each speaker participant gave instructions to our confederate decorator and they together completed four trees. The instructor sat in a soundproofed booth and was presented with a series of photo images, each showing a single ornament and a tree labeled at the intended hanging location. The instructor told the decorator sitting outside the booth what ornament to pick and where to place it. Each ornament label combined a color adjective and an object noun (e.g., green drum), and trial order was used to create adjective contrasts (e.g. green drum, blue drum) and noun contrasts (e.g. green drum, green ball). The conversations between the instructor and the decorator were fully transcribed and separately ToBI-annotated by annotators blind to experimental condition. ToBI annotation employed an ALT (alternative) tier for the recording of prosodically ambiguous productions (Veilleux, Shattuck-Hufnagle & Brugos, 2006). Duration and F0 values were extracted for words in the target [Adj+Noun] phrases and for their stressed syllables.

Transcription and ToBI annotation of data from ten speakers yielded 580 contrastive utterances, where target noun phrases produced consecutively in the discourse contained a repeated noun or adjective. Results indicate that contrastive adjectives were produced most frequently with L+H* (57% of trials), but also with H* (33%). Nouns following a contrastive adjective were most frequently unaccented (56%), many showing vowel reduction (34%). However, nouns produced after a contrastive adjective sometimes carried pitch accents (44%; a variety of pitch accent types). Contrastive nouns were produced more frequently with !H* or H* (55%) than with L+H* (25%). Adjectives preceding a contrastive noun were highly likely to carry a pitch accent (91%; 74% were H*). This was so despite the fact that the majority of these adjectives were the penultimate (immediately pre-nuclear) words in their utterances, and nuclear accents were found on the utterance-final word in the vast majority of contrastive noun productions (97%). Measures of the stressed vowels’ relative F0 height revealed that
unambiguous L+H* accents were higher than unambiguous H* and ambiguous L+H*/H* (where an alternative choice of a pitch accent was annotated) in both the adjective and the noun locations. Duration measures did not show such consistent patterns for either adjectives or nouns. Taken together, the present results indicate that during spontaneous dialogue, speakers express contrastive information primarily by the use of F0 changes, yet that the distribution of L+H* and H* on contrastive terms is strongly influenced by word location in the utterance.

References:


Effects of information structure on prosody: Comparing production and perception in Bangla

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This paper investigates the prosodic distinctions available in Bangla/Bengali to differentiate focus types. Bangla has canonical SOV order. The immediately preverbal position is the default focus position. Contrastive focus can also be marked morphologically with –i (Choudhury 2011). To broaden our understanding of the relationship between information-structure/prosody/syntax, we conducted an elicitation study (N=5) followed by a perception study (N=12) to investigate (i) whether Bangla speakers distinguish new-information vs. contrastive focus prosodically and (ii) whether the position of the focused constituent matters. Bangla has a default focus position, so we wanted to test whether prosodic distinctions between focus-types would be amplified in that position.

We manipulated focus type (new-information/contrastive focus) and grammatical role of the focused constituent (subject/object). In the elicitation phase, wh-questions were used to elicit new-information focus (ex.1a,b) and yes/no questions to elicit contrastive focus (1c,d).

1) Elicitation phase (Question and answers were presented to speakers in writing, in Bangla)
   (a) Subj wh (new-info focus) Who bought a car? baba gaRi kinlo ‘Father bought a car’
   (b) Obj wh (new-info focus) What did father buy? baba gaRi kinlo ‘Father bought a car’
   (c) Subj v/n (corrective foc) Did neighbor buy a car? baba gaRi kinlo ‘Father bought a car’
   (d) Obj v/n (corr foc) Did father buy a computer? baba gaRi kinlo ‘Father bought a car’

Perception study: Sentences from the elicitation phase were used as stimuli. For each grammatical role (subject/object), listeners saw a wh-question and a yes-no question (left/right positions were balanced) and heard a sound file elicited by a wh-question or a yes/no question of the same grammatical role (ex.2a,2b). They were told to choose the question that the sound file was the most appropriate answer for. If listeners distinguish focus types, we can attribute this to differences in the intonation/prosody, as the sentences were otherwise identical (ex.1).

   (2a) Screen showed: What did father buy? Did father buy a computer? [object condition]
       People hear: baba gaRi kinlo Father bought a car (elicited by obj wh-Q or obj y/n Q)

   (2b) Screen showed: Who bought a car? Did neighbor buy a car? [subject condition]
       People hear: baba gaRi kinlo Father bought a car (elicited by sub wh-Q or sub y/n Q)

Results: Overall, we find a wh-question preference (p’s<.05). However, in object conditions, this preference was lower with sound-files elicited by yes/no-questions than wh-questions (p’s<.05). In contrast, subject conditions showed no significant differences, triggering mostly wh-choices. Thus, listeners are prosodically distinguishing between focus-types only when the focused constituent is an object, in the default focus position.
Acoustic analysis/Elicitation study: We conducted acoustic analyses to see what cues signal focus type. Crosslinguistically, pitch and duration can signal focus (Ladd 1996), so we focused on them. (Due to an initial low pitch accent (Hayes/Lahiri 1991), mean F0 analyses were conducted on 10 time-normalized segments centered at noun offset, with Prosody Pro).

Results: As shown in Fig.1, new-information objects have lower mean F0 than contrastively-focused objects (p’s<.05). In addition, focused objects have higher F0 than unaccented objects (as in Hayes/Lahiri 1991). Like objects, new-information subjects have lower F0 than contrastively-focused subjects (p’s<.05). Crucially, unaccented subjects do not differ significantly from contrastively-focused or new-information subjects. In general, subjects have high F0, unlike objects, presumably due to initial prominence/F0 declination. This suggests the asymmetrical perceptibility of focus type on subjects/objects may be due to ‘crowding’: High F0 on subjects is not a reliable cue to focus type since unfocused subjects also have high F0. (We found no clear effects of pitch excursion or duration.)

As a whole, our findings indicate that Bangla, which has positional as well as morphological focus marking, also uses prosodic cues to differentiate new-information vs. contrastive focus, but that the availability of prosodic cues interacts with syntactic position such that prosodic differences between the focus-types are most apparent when the focused constituent is located in the default focus position.

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Figure 1.

[Normalized time: Time segments 1-10: subject, segments 10-20: object; segments 20-30: verb]
Can prosody be primed?
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Although prosodic phrasing is assumed to be a distinct, abstract level of linguistic representation (3), there is also work claiming that boundaries are simply temporary junctures where planning occurs (4). In three experiments, we investigate whether prosodic structure can be primed. Early work in production used priming of syntactic structure to argue for an abstract level of syntactic representation (2); by analogy, if prosodic structure can be primed, this would suggest that prosodic structure is also abstractly represented.

In all experiments, participants listened to sentences with and without relative clauses as in examples (a) and (b). The presence and location of intonational boundaries was manipulated such that the recording either included no intonational boundaries, a boundary in a structurally dispreferred location after the first verb, in a preferred location after the subject NP, or in both locations. In Experiment 1, participants repeated the sentences to test whether they might repeat the primed prosodic structure they heard. Experiments 2 and 3 then used a prime-target paradigm to evaluate whether the prosodic structure heard in the prime sentence might influence that of a target sentence. On prime trials, participants either repeated (Experiment 2) or did not repeat (Experiment 3) prime sentences out loud. On target trials, speakers silently read novel sentences and repeated them aloud from memory. Participants’ productions of all sentences were assessed in two ways: one coder rated whether a boundary was discernible in the two critical locations in participants’ responses, and a different coder measured the duration of the words produced before each boundary up to the onset of the first word following the boundary.

In Experiment 1, results from both analyses (n = 24) revealed that speakers were more likely to produce both preferred and dispreferred intonational boundaries at primed locations (all p’s < 0.01). Experiment 2 tested whether speakers would repeat novel target sentences with the same prosody as the recorded prime sentences. Both analyses (n=64) revealed a significant interaction between prosody condition and sentence type (prime vs. target) at both boundary locations (p’s < 0.05): participants repeated back the prosodic phrasing they heard, but this effect was only significant for the prime (listen-repeat) trials.

Priming of a prosodic representation may be very transient, and thus not robust enough to survive the time delay between hearing the prime and repeating the target. To test this hypothesis, Experiment 3 used a similar prime-target paradigm except that participants did not repeat the prime sentences out loud. Preliminary analyses of target responses (n = 31) revealed a priming effect only for the dispreferred boundary location.

These experiments suggest that it is possible to prime a prosodic representation (especially an infrequent one), but that this effect is not very long-lived. Thus, while prosodic structure is not as readily primeable as syntactic structure, it may nevertheless still be abstractly represented.
Examples
a) The dog that pawed the door needed to be let out. (No boundaries)
The dog that pawed the door// needed to be let out. (Dispreferred boundary)
The dog that pawed the door// needed to be let out. (Preferred boundary)
The dog that pawed the door// needed to be let out. (Both boundaries)
b) The accountant reviewed the material before the certification exam. (No boundaries)
The accountant reviewed the material before the certification exam. (Dispreferred boundary)
The accountant reviewed the material before the certification exam. (Preferred boundary)
The accountant reviewed the material before the certification exam. (Both boundaries)

References:
Spoken language contains various kinds of prosodic information such as pause, accent, amplitude, and pitch pattern. Previous research demonstrated that these prosodic cues play a non-trivial role in language comprehension [1]. In particular, several past studies demonstrated an effect of prosodic boundary in resolving structural ambiguity with so-called garden-path sentences [2,3,8]. In some, the effect was observed anticipatorily, that is, before the point of disambiguation. This is particularly important as such a finding shows an influence of prosodic information on listener's expectation about upcoming linguistic information, based on which recent sentence processing models estimate processing cost [4]. Currently, the studies that reported such an anticipatory effect are mostly limited to those on prosodic boundary [2, but see 5,6], which may be the most accessible type of cues as suggested by the finding with young children [7]. The current study tested an effect of contrastive intonation, the effect of which has been reported by past studies but was observed anticipatorily only with the preferred sentence structure [5]. We examined whether listeners can use this type of prosodic information to make a prediction about the correct analysis while processing structurally ambiguous sentences.

The current study examined temporary ambiguous relative clause sentences in Japanese such as (1). In Japanese, the relative clause neither takes an overt complimentizer nor involves any grammatical marking on the verb. Thus, the initial verb phrase (sanrinsha-ni notteiru, ‘riding on the tricycle’) is ambiguous between the main clause (MC) structure and the relative clause (RC) structure. In the current experiment using visual world eye-tracking paradigm, participants heard RC sentences that were either with contrastive intonation on the initial verb phrase (on the theme element; ‘tricycle’ more precisely) or without it. At the same time, they saw a visual scene that contained either an object that introduced a contrast to the RC-head noun (e.g., another little girl riding on a hobbyhorse) or an object that did not (e.g., a woman riding on a bicycle).

The results revealed a significant interaction between prosody and visual information. Further analysis showed that when the visual scene entailed a contrast, participants looked more at the correct RC-head entity immediately on hearing the initial verb phrase when the sentence carried the contrastive intonation than when it did not. Importantly, the effect was observed before the onset of the RC-head. On the contrary, when the scene did not entail a contrast, there was no difference in looks to the RC-head entity depending on the presence of the prosodic cue. Furthermore, we observed the effect of prosody after encountering the disambiguating information as well. The results suggest that the processing of the RC-head (i.e., disambiguating information) following the RC modifier with the contrastive intonation was facilitated due to the earlier prediction. Taken together, the current study demonstrated that listeners can make a prediction about the correct RC analysis using contextually appropriate prosodic cues, that is, the contrastive intonation in the presence of contrastive context.
Example
1. Otokonoko-ga sanrinsha-ni notteiru onnanoko-wo mitsumeta.
   Subject [RC-object RC-verb] RC-head MC-verb
   Boy-NOM [tricycle-DAT was riding] girl-ACC stared at
   ‘The boy stared at the girl who was riding on the tricycle.’

References:
Phonologically-mediated eye movements are modulated by formal literacy

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Evidence from a variety of behavioral and neuroimaging studies suggests that learning to read and write has cognitive consequences that go beyond the processing of written material. We investigated whether the ability to read and write exerts an influence on spoken language-mediated visual orienting (e.g., "can you see the cat"?), a simple look and listen task which resembles everyday behavior by readers and non-readers alike. Participants were high literates (15 year mean years of formal education) and low literates (2 mean years of formal education) from Allahabad (India). Pre-tests confirmed the appropriate assignment of the participants to the two groups.

In Experiment 1, high and low literates listened to simple spoken sentences containing a target word (e.g., 'mgar', crocodile) while at the same time looking at a visual display of four objects (a phonological competitor of the target word, e.g., 'matar', peas; a semantic competitor, e.g., 'kachuwa', turtle, and two unrelated distractors). In Experiment 2 the semantic competitor was replaced with another unrelated distractor. Both groups of participants shifted their eye gaze to the semantic competitors (Experiment 1). In both experiments high literates shifted their eye gaze towards phonological competitors as soon as phonological information became available and moved their eyes away as soon as the acoustic information mismatched. This pattern of results with Indian high literates replicates previous results with Dutch high literates. Low literates in contrast only used phonological information when semantic matches between spoken word and visual referent were impossible (Experiment 2) but in contrast to high literates these phonologically-mediated shifts in eye gaze were not closely time-locked to the concurrent speech input.

We conclude that in high literates language-mediated shifts in overt attention are co-determined by the type of information in the visual environment, the timing of cascaded processing in the word- and object-recognition systems, and the temporal unfolding of the spoken language. Our findings indicate that low literates exhibit a similar cognitive behavior but instead of participating in a tug-of-war among multiple types of cognitive representations, word-object mapping appears to be achieved primarily at the semantic level. If forced, for instance by a situation in which semantic matches are not present (Experiment 2), low literates may on occasion have to rely on phonological information but do so in a much less proficient manner than their highly literate counterparts.
Anticipatory eye movements in wh-movement: A comparison of younger and older adults

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Studies have shown that people can anticipate an upcoming word (or object) based on several types of linguistic constraints, such as a verb’s selectional restrictions (Altmann & Kamide, 1999). Sussman and Sedivy (2001) also observed anticipatory eye movements in sentences containing wh-movement. When participants heard questions (e.g. What did Jody squash the spider with?), they found that people tended to anticipate the object (spider), whilst hearing the verb (squash). However, there has been some controversy about the input rate of speech and people’s ability to actively predict gaps in wh-questions (Dickey & Thompson, 2009; Love, Swinney, Walenski, & Zurif, 2008). In this study, we used the visual world paradigm to examine how speech rate and general processing speed influence the comprehension system’s ability to anticipate an upcoming object in a wh-question. We systematically varied speech rate (3.5, 4.5, or 5.5 syllables per second), and to investigate individual differences in processing speed, we tested older adults. Prominent theories of ageing assume a general decrease in processing speed throughout middle and late adulthood (Salthouse, 2009). We predicted that older adults would be slower shifting attention to the relevant object in the display compared to younger adults. More importantly, if input rate also affects people’s ability to actively anticipate an upcoming object, then we expect an interaction between input rate and processing speed.

Participants viewed arrays of objects and listened to short narratives, for example, about a boy kissing a girl at school. The array contained a boy, a girl, a school, and a distractor. Participants were then asked a question (e.g. Who did the boy kiss t, atschool?), and they had to click on the correct image. We analyzed eye-movements and comprehension accuracy using 2x3 (age group x speech rate) mixed model ANOVAs. The duration of the word following the verb was 200-320ms. Given that it takes approximately 200ms to program a saccade, we examined target-advantage scores (target minus competitor) for the word following the verb (word 1), under the assumption that fixations during this window were programmed during the second half of the verb or immediately after. Results from the verb (verb) and the second word after the verb (word 2) were also analyzed. We found a significant linear effect of input rate at word 1 $F(2,72)=4.01, p<.05$ and word 2 $F(2,72)=3.09, p<.05$ (see figure). Simple effects revealed a significant difference between the 3.5 and 5.5 syllable/sec rate for both word 1 $F(37)=2.47, p<.05$, and word 2 $F(37)=2.65, p<.05$. We found no effect of age at any word. However, we ran sub-analysis on adults over 46 yrs ($N=11, M=56.9$). A one-sample t-test, with a test value of zero, revealed that they performed no differently from chance in both the 4.5 $t(10)=.81, p=.44$ and 5.5 $t(10)=.54, p=.60$ syllable/sec conditions. This suggests that processing speed can also influence the extent to which people anticipate upcoming objects in speech. There was no difference in comprehension accuracy. Results are consistent with previous work in demonstrating that the comprehension system will actively predict a gap following the verb and actively anticipate the object of that verb when the input rate allows. Moreover, these results (1) resolve the debate concerning how different input rates affect online processing, and (2) have implications for the speed in which incremental interpretations can be exploited in the service of active prediction in language comprehension.
References:


Re-examining the role of cognitive control in children’s sentence processing
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The cognitive control account of child sentence processing proposes that preschoolers’
difficulty recovering from garden paths may derive from underdeveloped inhibition skills
(i.e., immature prefrontal cortex, associated with executive functions [1]). This has received
partial support in that both Korean and English-learning 3-5-year-olds show a tendency to
rely on early-arising information within a sentence (morphosyntax in Korean; verb
information in English) and have difficulty overriding their initial sentence interpretation
when later information required revision [2]. However, no direct relation between inhibition
measures and children’s parsing abilities has been observed to date. For instance, no
correlation was observed between children’s Snow-Grass task performance (a measure of
preschooler’s inhibition [3]) and sentence interpretation errors [4]. This was unexpected since
adult studies support such a relationship (e.g., with Stroop task, [5]). Prior child studies,
however, were limited due to the small number and restricted age range of participants and
limited inhibition measures (a single measure in [4]). Here we re-examine the relationship
between cognitive control and parsing by testing a wider age range (3-6 years) and taking
multiple cognitive control related measures.

Fifty-six Korean-speaking children (37-79 months) acted out temporarily ambiguous
sentences such as “napkin-on tomato-acc pick up (‘Pick up the tomato on the napkin’),”
where napkin-on could be interpreted initially as a Destination for a verb or a Modifier for a
noun. The sentence was pronounced either with Destination-Prosody (major break between
first and second phrase), or Modifier-Prosody (no break between first and second phrase).
Unambiguous sentences were used as controls (see Examples). Like prior studies, children
were more likely to make interpretation errors (e.g., taking ‘napkin’ as a destination) when
the sentences were ambiguous, with the effect being largest in younger children. To measure
inhibition, multiple tasks were administered: a Stroop task (Red/Blue dog: naming the dog
not the color of the dog), a Dimensional Change Card Sorting (DCCS) task, and a Go-Stop
task. Additionally, children’s working memory span (Visually Cued Recall (VCR) task) was
obtained. We also asked parents to report on their child’s behavior regulation (e.g., the child
can speak quietly when asked).

Among these measures, sentence interpretation accuracy in Modifier-Prosody condition
showed a positive correlation with DCCS-inhibition score (higher score means better
inhibition) ($r = .36$) and a negative one ($r = -.37$) with DCCS-perseveration score (higher
score means more perseveration), suggesting that cognitive flexibility is associated with
 parsing accuracy. Also, interpretation error rates (i.e., destination-responses) in Destination-
Prosody condition showed a negative correlation with parents’ observation on their child’s
ability to regulate behaviors ($r = -.36$), suggesting that children who were better able to
regulate their behaviors were less likely to make interpretation errors. However, other
inhibitive measures (Stroop & Go-Stop task) and working memory (VCR) didn’t correlate
with sentence measures, although inhibitive and working memory measures showed high
correlations amongst them.

Taken together, these results uncover specific relations between cognitive control and
developing sentence processing abilities. Past failures to find such connections may reflect
the differing sensitivity of these tasks to measure cognitive control in children.
Example Sentences used in the Sentence Act-out Task:

1) Destination-Prosody condition (4 sentences total):
   \[\text{naypkin-ey} \rightarrow [\text{tomato-ru} \text{cipuseyo}]\] (major break between 1st and 2nd phrase)
   \text{napkin-on tomato-ACC pickup} “Pick up the tomato on the napkin.”

2) Modifier-Prosody condition (4 sentences total):
   \[\text{naypkin-ey tomato-ru} \rightarrow [\text{cipuseyo}]\] (no break between 1st and 2nd phrase)
   “Pick up the tomato on the napkin.”

3) Unambiguous control (4 sentences total):
   \text{naypkin-ey iss-nun tomato-ru} \text{cipuseyo}
   \text{napkin-on is-that tomato-ACC pickup}
   “Pick up the tomato on the napkin.”

References


Do people differ in their use of heuristics in sentence processing?

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It is a well-known phenomenon that many interpersonal verbs impute causality to either subject or object of an event (Garvey & Caramazza, 1974). Some verbs (e.g., “annoy” in 1a below; expected pronoun in parentheses) tend to highlight the subject as the cause of the event (subject-biased verbs); others (e.g., “notice” in 1b) are biased towards the object (object-biased verbs).

(1)  
a. Oskar annoyed Emma, because (he)…  
b. Oskar noticed Emma, because (she)…

This implicit causality is not a binary assignment but only a probabilistic property of those verbs; encountering a bias-incongruent pronoun like “she” in 2b results in longer first-pass reading times and regression path durations (Koornneef & Berkum, 2006; Featherstone & Sturt, 2010), and a pronounced P600 (Berkum, Koornneef, Otten, & Nieuwland, 2007).

(2)  
a. Oskar noticed Emma, because she waved at him.  
b. Emma noticed Oskar, because she looked up.

In addition, individual differences in the use of implicit causality have been explored, but with equivocal results: Whereas Long and De Ley (2000) report an early effect of incongruence (in a probe-recognition task) only among participants that scored high in a Nelson-Denny Reading Test, Koornneef and Berkum (2006) do not find a corresponding interaction of participants’ working memory capacity (assessed with a Reading Span Task) and the magnitude of their response to unexpected pronouns (in self-paced reading and eye-tracking). Thus, it is not clear if there are individual differences in the use of implicit causality.

A number of psycholinguistic studies report individual differences in language processing (e.g., Just & Carpenter, 1992; Mecklinger, Schriefers, Steinhauer, & Friederici, 1995), albeit mostly for the resolution of syntactic ambiguities. We conducted an eye-tracking experiment to investigate whether an individual’s working memory capacity modulates the effect of pronouns that are incongruent with a verb’s implicit causality, and thus used a subtle manipulation where the resolution towards the subordinate interpretation did not affect the syntactic structure of the sentence. We assessed our participants’ working memory capacity with an Operation Span Task (Turner & Engle, 1989).

Incongruent pronouns led to a higher probability of re-reading the verb, object, conjunction, and pronoun ($z > 2$) and longer re-reading times on the subject and the verb of the main clause ($t > 2$). We also found a higher first-pass regression probability from post-critical regions ($z > 2$) in incongruent sentences. Moreover, individuals with a higher operation span showed a greater effect of bias-incongruence in the re-reading probability for the verb (Est. = 0.17, CI = ±0.16, $z = 2.1$, $p > .05$).

Figure 1: Re-reading time and probability on the verb as a function of congruence and working memory capacity (grouped for illustrative purposes).
Our results suggest that individuals with a higher working memory capacity inhibit the subordinate interpretation of a proposition, whereas individuals with lower capacity maintain all interpretations regardless of their respective probability. Consequently, high-span readers have to engage in reanalysis when they encounter an unusual configuration such as an incongruent pronoun in our experiment. Low-span readers can retrieve the subordinate interpretation from active memory and thus show a smaller effect of incongruence. This interpretation is in line with Friederici, Steinhauser, Mecklinger, and Meyer (1998) and Gunter, Wagner, and Friederici (2003), who show that only individuals with a larger working memory capacity suppress the subordinate interpretation of syntactic ambiguities and homonyms. Evidence from the research on working memory and executive control gives further support to the inhibition hypothesis (Unsworth, Schrock, & Engle, 2004). Moreover, our results indicate that individual differences in language processing are not constrained to structural phenomena but also extend to subdued heuristic properties like implicit causality.

References:
Working memory effects of information structure in German left dislocation (GLD)

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Sentences with object-before-subject (OS) orders have been shown to place a greater demand on working memory than subject-before-object (SO) orders (e.g. Hemforth 1993). Additionally, it has been shown that the processing demand for OS orders can be alleviated through contextual licensing of a given information structure (IS: contrast, focus, givenness; e.g. Stolterfoht & Bader 2004; Bornkessel & Schlesewksy 2006). In our study we investigate whether IS-marking (via intonation) influences the processing of GLD sentences with SO vs. OS orders. GLD is a construction where a DP occurs at the left periphery and is taken up later in the clause by a resumptive d-pronoun (RP) with the same case/number/person features:

(1) Der Fuchs, der jagt den Wolf.
   the.NOM fox RP.NOM chases the.ACC wolf
   Rough translation: 'The fox chases the wolf.'

GLD has been argued to mark topics (Frey 2004) but (2)&(3) show that it can also mark foci. In (2) a focus particle (only) associates with the dislocated phrase; (3) answers a *wh*-question.

(2) Context: Nobody understands this theorem right away.
   Nur der Streber dort, der hat's natürlich sofort gecheckt.
   only the.NOM teachers.pet there RP.NOM has.it.of.course right.away understood
   'Only that teacher's pet over there, he got it right away of course.'

(3) Context: Who went to the contest?
   Der Direktor, der ist gegangen.
   the director RP.NOM is gone
   'The director, he went.'

The structures that mark topics vs. foci are differentiated prosodically. Topics have a rising accent, the RP being deaccented. Foci have a falling accent, with the RP also carrying a falling accent. In the examples below (see (4-7)) accents are marked with small capitals. A forward slash marks a rising accent, a backward slash marks a falling accent.

In our study, 40 participants listened to pre-recorded GLD sentences like (4-7) where SO order and IS were varied, yielding four conditions: S_{TOP-O}, O_{TOP-S}, S_{FOC-O}, O_{FOC-S}. All sentences were transitive (NOM-ACC). In the SO sentences the subject was left-dislocated, in the OS sentences the object was left-dislocated. The TOP-sentences (S_{TOP}; O_{TOP}) had topic intonation, the FOC-sentences (S_{FOC}; O_{FOC}) had focus intonation.

(4) S_{TOP-O} Der /FUCHS, der jagt den Wolf.
   the.NOM fox RP.NOM chases the.ACC wolf
(5) O_{TOP-S} Den /WOLF, den jagt der Fuchs.
   the.ACC wolf RP.ACC chases the.NOM wolf
(6) S_{FOC-O} Der /FUCHS, DER jagt den Wolf.
(7) O_{FOC-S} Den /WOLF, DEN jagt der Fuchs.

Rough translation for (4)-(7): 'The fox chases the wolf.'
After participants heard a trial, they judged the correctness of a mathematical equation, which served to engage their working memory in a non-linguistic domain. Then they saw a prompt (subject or object noun) and recalled the sentence.

Our analysis of reaction times for the judgment of the equation revealed a main effect for order and IS, as well as an interaction. Equations were judged faster (i) after participants had heard an $O_{TOP}$-S sentence compared to a $S_{TOP}$-O sentence, (ii) after participants had heard a $S_{FOC}$-O sentence compared to an $O_{FOC}$-S sentence, (iii) after participants had heard an $O_{TOP}$-S sentence compared to a $O_{FOC}$-S sentence, and (iv) after participants had heard a $S_{FOC}$-O sentence compared to a $S_{TOP}$-O sentence. There was no effect of judgment accuracy. Analysis of the reaction times for the recall revealed a two-way interaction of IS and order, and a three-way interaction of prompt type, IS and order. After a subject prompt, recall was (i) faster for $S_{TOP}$-O than for $S_{FOC}$-O, (ii) faster for $O_{FOC}$-S than for $O_{TOP}$-S, (iii) faster for $S_{TOP}$-O than for $O_{TOP}$-S, and (iv) faster for $O_{FOC}$-S than for $S_{FOC}$-O. After an object prompt, recall was faster for $S_{FOC}$-O than for $S_{TOP}$-O.

The results of the maths task suggest that in GLD an OS order has a processing advantage over a SO order regarding working memory during processing, if the object is clearly marked as topic by the appropriate prosody in this specific structure. The typical SO advantage is overwritten in this case. We suggest that this is because an object cannot be interpreted as topical in its canonical position so left dislocation can be considered a canonical position for topical objects. Marking topical objects this way is advantageous for discourse organization, where topics are addresses for storing information (Reinhart 1981). Subjects are prototypical topics. Therefore a special marking is superfluous and costly – leading to higher processing costs (reflected in the reaction times in the non-linguistic task). If subjects are focus-marked in an SO sentence, they have the usual advantage over an OS sentences with a focused object. For the recall our results suggest that a subject prompt facilitates retrieval of a SO sentence if the subject of that sentence is a topic rather than a focus. This suggests that the sentence was stored under the topic address when it was processed, confirming the idea of the address function of topics in discourse: information stored under a specific address can be retrieved faster. Further, a subject prompt facilitates the recall of an OS sentence if the sentence-initial dislocated object is a focus rather than a topic. We suggest that in the former case the non-dislocated subject is the topic, again confirming the address metaphor. Similarly, an object prompt facilitates the recall of a sentence where the dislocated subject was a focus, i.e. not topical, in comparison to a sentence where that subject was the topic.

References:


The effect of L1 word order on the sensitivity to verb bias in English L2 processing
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Most verbs can appear in multiple sentence structures, but for many of them some structures are more likely than others. In English, verbs appear early enough in sentences to allow verb-based predictions about likely upcoming structure. However, in verb-final languages like Korean, verbs come too late to allow such predictions. This study examines whether English-L2 speakers with a verb-final L1 learn to use verb bias predictively when understanding English sentences like those in (1) below. The question is whether L2 learners are flexible enough to learn to attend to cues that are not useful in their L1.

The post-verbal nouns in (1) are temporarily ambiguous because the optional complementizer that is missing. Before the disambiguating verb (would in 1a) appears, the noun could be a direct object (DO) or the subject of a sentential complement (SC). The verb understood in (1a) takes DOs more often (DO-bias verb) while the verb admitted in (1b) has the opposite pattern (SC-bias verb). Several studies (e.g., Garnsey et al., 1997) have found that words disambiguating toward the sentential complement are read more slowly following DO-bias verbs than following SC-bias verbs.

In the present study, verb bias and ambiguity (i.e., presence or absence of that) were manipulated in sentences containing sentential complements. (Distractors had DO structures.) The temporarily ambiguous noun was always plausible as both a DO and the subject of an SC. Sentences were presented in a self-paced moving window reading paradigm, followed by comprehension questions. Three groups of participants included 32 native English speakers, 22 advanced Korean learners of L2-English, and 29 proficiency-matched Mandarin learners of L2-English. Mandarin-L1 speakers were included because Mandarin has the same SVO order as English and verb bias has been found to influence reading times in Mandarin sentences (Lu & Garnsey, 2008; see also Dussias & Crammer Scaltz, 2008 for verb bias use in English by Spanish-L1 adult learners). On another dimension, though, Mandarin differs from Korean and English, which both have complementizers: The optional clause-initial that in English and the obligatory nominalization particle (e.g., nun kes) attached to the embedded verb in Korean. Mandarin, in contrast, has no complementizer. Thus, compared to native English speakers, Korean-L1 learners of English may be less sensitive to verb bias and Mandarin-L1 learners less sensitive to complementizer presence. Again, the general question is whether adult L2 learners are more sensitive to cues in the L2 that are also useful in their L1.

Native English speakers showed the usual reliable interaction between verb bias and ambiguity while neither group of L2 learners did. As predicted from the properties of their L1, Mandarin-L1 speakers’ reading times were reliably influenced by verb bias regardless of whether the sentence included the complementizer, while Korean-L1 speakers were reliably influenced by complementizer presence regardless of verb bias.

Taken together, the results suggest that the properties of the L1 shape adult learners’ strategies in parsing L2 English sentences.
(1) a. The club members understood (that) the bylaws would be applied to everyone.
b. The ticket agent admitted (that) the mistake might be hard to correct.

References:


Acquiring English dative verbs: Proficiency effects in French L2 learners

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We present a Visual World eye-tracking experiment investigating the comprehension of English dative constructions by French L2 learners. Native speakers' comprehension and production of syntactic alternations is influenced - among other factors - by idiosyncratic distributional properties of the lexical items involved. One alternation that has received particular attention is the dative alternation (1). Comparing the verbs serve and offer, which have similar meaning in contexts like (1), one finds that the former shows a stronger bias towards being used in the prepositional dative construction (1a) whereas the other has a bias towards double object constructions (1b) (Bresnan et al. 2007).

(1a) The maid will offer/serve the wine to the prince. (prepositional dative)
(1b) The maid will offer/serve the prince the wine. (double-object dative)

The acquisition of these constraints in a second-language context, however, has received less attention. Wolk et al. (2011) investigated whether probabilistic characteristics of the target language – English- influence German learners, and if so, by what time-course. They showed that less proficient learners showed little verb bias effects in the construction that was dominant in their L1 (DO). In most contexts, German does not have a prepositional dative object, and the ordering of objects in the double object construction, although free in principle, is preferred to be recipient before theme, thus matching the order of the English double object dative. In French, on the other hand, the prepositional object construction is the predominant pattern.

We present data from French learners of English varying in proficiency. The visual world study is a replication of the experiment in Tily et al. (2008) and Wolk et al. (2011). Participants are presented with depictions of subject, recipient and theme while listening to a recording of dative sentences. We then compare anticipatory eye-movements across dative realizations, verb biases and proficiency groups, finding that speakers indeed acquire the norms of the target language; however, we found the sensitivity for verb bias to be stronger for advanced speakers in both constructions.

The data suggest that subtle probabilistic distributions in the target language have been acquired only by advanced learners. Potential differences between German and French L2 learners of English will be discussed.

References:
Acquisition of English verb transitivity by native speakers of Japanese

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This study investigates native Japanese speakers’ acquisition of English lexical causativity (Bowerman, 1974). Semantic class and frequency of verbs (Levin, 1993; Brooks & Tomasello, 1999) have been proposed as influences on the first language (L1) acquisition of verb causativity. The goal of this study is to investigate the role of these two factors in second language (L2) acquisition.

Recent studies argue that children acquire L1 lexical causativity through verb semantics and that high-frequency verbs are acquired earlier than low-frequency ones (Ambridge et al., 2008). For example, verbs whose meaning entails willed or volitional acts (e.g., work, toil, smile, grin) are typically pure intransitives in most languages and are not allowed in the transitive construction. Among those verbs, high-frequency forms, such as work and smile, are expected to be acquired faster than low-frequency ones such as toil and grin.

In addition, the subset-superset relationship between L1 and L2 (Inagaki, 2001, 2002; Izumi, 1998; Montrul, 2001) may play a role in SLA because the way each language manifests lexical causativity varies (Haspelmath, 1993; Jacobsen, 1992). In Japanese, lexical causatives exist not only in typical unaccusative verbs (e.g., open, break, bounce), but also in unaccusative verbs lacking the causative alternation in English; that is, inherently-directed motion verbs (e.g., oriru/orosu “descend INTRANS/TRANS”, go, tumble) and verbs of disappearance (e.g., kieru/kesu “disappear INTRANS/TRANS”, die, vanish). The subset-superset relationship predicts learnability problem for Japanese native speakers acquiring L2 English when the learners encounter inherently-directed motion verbs and verbs of disappearance. In addition, the learnability problem from the lack of negative evidence is expected to be stronger with low-frequency tokens than with high-frequency ones.

Twenty-six native English speakers and 18 high- and 17 low-proficiency Japanese ESL learners participated in a computer-based experiment which consisted of a series of short movie clips followed by an English sentence. The sentences contained verbs from different frequency strata (frequency counts in CELEX2). For example, die (high-frequency), disappear (mid-frequency), and vanish (low-frequency) were selected from the disappearance verb class. Each verb was used in three different frames: an agent intransitive frame (e.g., “*The man vanished.” in the sense of the man made something disappear), a theme intransitive frame (e.g., “The coin vanished.”), and a transitive frame (“*The man vanished the coin.”). The subjects were asked to rate each sentence’s acceptability (Likert scale 1-5).

The data were analyzed with a 3x2x3 RM ANOVA using Proficiency as a between-subjects factor and Verb Semantic Class and Frequency as within-subjects factors. There were significant main effects for all three variables, a two-way interaction between Frequency and Semantic Class ($F(10,580) = 5.48, p < .001$), and a three-way interaction ($F(20,580) = 5.48, p < .05$). As expected, post-hoc analyses showed significant Frequency and Proficiency effects in the disappear and inherently-directed motion verbs, but not in the prototypical unaccusative verb class, supporting the hypothesis that L2 learners acquire verb causativity under the influence of Semantic Class, Frequency, and learnability predicted by the subset relationship.
References:
The Linguistic Cues for Event Mapping in L2 Verb Learning
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In language learning, learners have to link a word form to its concept. It is said that verb learning is especially difficult for learners because they must take the ever-changing events in the world and transform them into a categorical system represented by language \cite{1,2}. Despite these difficulties, children can still learn verbs efficiently using linguistic cues (e.g., syntactic structures \cite{3,4} or case particles \cite{5}). Although the difficulties have also been reported in L2 \cite{6}, the effectiveness of linguistic cues in verb learning has not been examined. We conducted a novel experiment on adult Chinese advanced learners of Japanese (CL) and Japanese native speakers (NS). By utilizing causative events we examined whether L2 verb learning is guided by linguistic cues, based on the following reasons: (1) Japanese expresses an entire causative event involving Action and Result aspects in a single verb while Chinese expresses it in a combination of verbs \cite{7}, and (2) Case particles are used in Japanese, but not in Chinese.

Participants (NS=24, CL=17) did a learning phase and then an evaluation phase. In the learning phase, participants heard a Japanese novel verb (e.g., meker-imasu) in one of three conditions: a verb that is preceded by (a) an agent with a nominative marker (Agent-Nom) or (b) a patient with a nominative marker (Patient-Nom), or (c) a verb alone (VerbOnly). Each sentence was accompanied by an animation movie depicting a full causative event involving Action and Result components (Figure1). In the evaluation phase, participants saw a sub-component of the same causative event, that is, either Action or Result part. Then participants responded whether the animation shown in the evaluation phase matches the verb meaning that they had learned in the learning phase.

We predicted that when causative events were described in Agent-Nom sentences, participants would use semantic roles and a case marker as cues to map the verb to an Action or to both Action and Result components of the causative event. On the other hand, participants would map the verb to a Result component when causative events were expressed in Patient-Nom sentences. When no cues that could guide a conceptual-verb mapping were provided as in VerbOnly condition, CL would map the (single) verb to only one aspect of causative events because Chinese speakers understand causative events as a combination of verbs in their native language.

As predicted, in Agent-Nom, both language groups accepted Action more than Result (Action: NS 56%; CL 75% and Result: NS 13%; CL 8%), but the pattern was reversed in Patient-Nom (Action: NS 2%; CL 3% and Result: NS 92%; CL 81%) (Figure2). This indicates that both language groups use case particles and semantic roles as effective cues to map a particular aspect of the event onto the verb meaning. In VerbOnly, an interaction was found between Language and Evaluation ($F(1,35)=7.34$, $p<.05$). That is, CL accepted Result more than NS (NS 19%; CL 57%). Our results reveal that (1) CL can abstract an aspect as effectively as NS when a verb is learned with a case particle and a noun and (2) CL employ their L1 knowledge in learning Japanese novel verbs when no syntactic and nominal cues are available.
Experiment Examples
(a) Agent-Nom: “Hito - Ga mekerimasu (someone will mekeru (something)).”
(b) Patient-Nom: “Mono - Ga mekerimasu (something will mekeru).”
(c) VerbOnly: “Mekerimasu ((someone) will mekeru (something)).”

Causative event (used in the Learning Phase)

Action component
(used in the Evaluation Phase)

Result component
(used in the Evaluation Phase)

Figure 1 The Sample Animation of Causative Event

<table>
<thead>
<tr>
<th>Conditions and Languages</th>
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<tbody>
<tr>
<td>Mean percentage of acceptance</td>
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<tr>
<td>0%</td>
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<tr>
<td>NS</td>
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<tr>
<td>Patient-Nom</td>
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<tr>
<td>VerbalOnly</td>
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Figure 2 The proportion that participants accepted the learned verbs

References
Reduced Proficiency in a Second Language Leads to Delays in Early Lexical Processing

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The temporal delay assumption of the BIA+ model (Dijkstra & van Heuven, 2002) states that lexical access is delayed in bilinguals’ second language (L2) compared to their first (L1) because of lower proficiency. The reduced frequency hypothesis (Pyers et al., 2009) proposes that bilinguals’ use of multiple languages leads to reduced frequency of use and therefore weaker language ties in the L1 compared to monolinguals. However, as it is generally a language production hypothesis, it is unclear whether the reduced frequency hypothesis extends to word recognition studies, predicting slower lexical access in bilinguals’ L1 compared to monolinguals. Previous EEG studies investigating lexical processing speed have mainly either failed to test monolinguals against both languages of bilinguals (Proverbio et al., 2009), and/or have focused on later semantic components like the N400 (Ardal et al., 1990; van Heuven & Dijkstra, 2010).

We investigate these two hypotheses of lexical processing speed in the context of automatic reading by directly comparing monolinguals and bilinguals in L1 and L2 using concurrent EEG. We focus on an early orthographic recognition component, the N170, which is shown to be sensitive to language proficiency (Maurer et al., 2005). The Stroop task is used as a measure of automatic word processing, with long-latency stimulus onset asynchrony (SOA) variation (-400 ms, 0 ms, +400 ms) to gain additional automatic and temporal information on lexical processing in native and second languages. Experiment 1 tested monolingual English speakers on an English Stroop task with 128-channel EEG recording. Experiment 2 tested Chinese-English bilinguals on Chinese (L1) and English (L2) Stroop tasks in separate sessions. All bilinguals were native Chinese speakers with a late age of English acquisition (mean 11 years) and a self-rated English proficiency of 7/10.

An N170 was seen following word presentation in all SOAs for monolinguals and for bilinguals in both languages, demonstrating the automaticity of word reading even in a second language. At the N170 peak, monolinguals and bilinguals’ L1 showed differences in the symbol string control condition (‘%’) relative to word conditions. In the L2, words and symbol strings were distinguished later, on the downslope of the N170 peak. To directly compare the groups, difference waves (incongruent minus symbol string) were computed for each group and SOA. The difference waves showed peaks at 170 ms for monolinguals and bilinguals’ L1, reflecting lexical distinction at the N170 peak. These peaks did not significantly differ in latency, indicating no difference in lexical processing speed between bilinguals’ native language compared to monolinguals. The bilingual L2 lexical distinction peak, however, occurred significantly later (100 ms) compared to both the L1 and monolinguals (Figure 1) in all SOAs and despite repetition effects, suggesting a robust delay in lexical processing.

Thus monolinguals and bilinguals’ L1 showed no latency differences in lexical processing, suggesting that the reduced frequency hypothesis does not hold for bilingual word recognition. The L2, however, experienced significantly delayed early lexical processing, supporting the temporal delay assumption and confirming that a second language is...
automatically activated but significantly delayed due to reduced proficiency and frequency of use.

References:

**Figure 1:** Difference waves (incongruent – symbol string) at electrode P7 (left tempo-parietal) for the -400 ms SOA (word appears 400 ms before colour), 0 ms SOA (colour and word simultaneous), and +400 ms SOA (word appears 400 ms after colour). Shaded regions indicate lexical processing peaks, representing the orthographic distinction between words and symbol strings, for monolinguals and bilinguals’ L1 (no difference; blue boxes), and bilinguals’ L2 (significantly delayed; pink boxes).
Determinants of relative clause processing in Japanese as a second language

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Subject relative clauses (SRs) are easier to process than object relative clauses (ORs) in many languages. In order to explain this fact, previous studies have mostly examined the effects of universal factors such as structural distance (SDH: O’Grady, 1997), linear distance (LDH: Gibson, 1998), frequency (Reali & Christiansen, 2007). In Japanese, regarding the processing asymmetry between SRs and ORs, Sato et al. (2009) argued that language-specific factors should also be taken into consideration, and proposed ‘case driven expectation hypothesis’ (CDEH). According to CDEH, Japanese relative clauses (RCs) are processed more easily if there is an early expectation for another NP before the verb is encountered. In Japanese, since nominative-NP misses in its canonical position, sentence initial accusative-NP in SRs elicits an early expectation for another NP, whereas sentence initial nominative-NP in ORs does not. Therefore SRs are easier to process than ORs (Sato et al., 2009). In the case of second language (L2), it is still unknown to what extent the language-specific factors may affect the sentence processing. In the present study, in order to explore the possible effects of universal and language-specific factors in Japanese as an L2, we conducted two self-paced reading experiments with 26 higher-intermediate Turkish speaking learners. Turkish is an SOV language, and word order of RCs is identical to Japanese. Moreover, NPs bear overt case markers within RCs as in Japanese. In order to make sure that participants can use case marker information, we conducted experiments with Turkish learners.

In Experiment 1, we examined whether there is a processing asymmetry between SRs and ORs (see (1)). The results showed that the head-noun of SRs was read faster than that of ORs, \( F_1 (1,25) = 7.74, p < .01; F_2 (1,23) = 3.88, p = .06 \). This result is consistent with previous studies in Japanese (e.g., L1: Ishizuka, 2005; L2: Kanno, 2001), indicating that LDH cannot explain the processing asymmetry. However, SDH, frequency and CDEH may still explain the results of Experiment 1. In order to distinguish among these possibilities, we utilized the nominative-genitive conversion to RCs in Experiment 2.

In Japanese, the subject noun of ORs can bear both nominative (NOM-RCs) and genitive case (GEN-RCs) (see (2)), but the use of genitive case is very limited (Kim, 2009). If frequency is the decisive factor, NOM-RCs should be read faster than GEN-RCs. However, structural distance is equal in NOM-RCs and GEN-RCs. Therefore, there should not be any difference between two conditions. In the case of CDEH, a genitive-NP elicits early expectation for another NP compared to nominative-NP. Therefore, GEN-RCs should be read faster than NOM-RCs. The results of Experiment 2 showed that the head-noun of GEN-RCs was read faster than NOM-RCs \( F_1 (1,25) = 5.41, p < .05; F_2 (1,23) = 2.98, p = .10 \). This indicates that CDEH can explain the results of Experiment 2, whereas other factors cannot.

Overall our study suggested that CDEH can capture entire results, whereas LDH, SDH and frequency failed to explain processing difficulty of Japanese RCs. This indicates that higher-intermediate Turkish speaking learners facilitated information from case markers to process Japanese RCs, and ‘case driven expectation’ is one of the most important factors in Japanese as an L2. Therefore, in addition to universal factors, we also need to take language-specific factors and learners’ first language into consideration in L2 sentence processing as well.
Experimental Materials and reading times

Experiment 1

(1a) SR condition
Depato-de ryoushin-o sagashite-ita kodomo-wa kyuuni nakidashita
dep.store-LOC parents-ACC seek-PROG child-TOP suddenly cried
‘The child who was looking for the parents at department store suddenly cried.’

(1b) OR condition
Depato-de ryoushin-ga sagashite-ita kodomo-wa kyuuni nakidashita
dep.store-LOC parents-NOM seek-PROG child-TOP suddenly cried
‘The child who the parents was looking for at department store suddenly cried.’

![Fig. 1 Reading times of SRs and ORs](image1)

Experiment 2

(2a) NOM-RC condition
Sengetsu gakusei-ga kaita sakubun-wa sugoku omoshirokatta
Last month student-NOM wrote composition-TOP very interesting
‘The composition that the student wrote last month was very interesting.’

(2b) GEN-RC condition
Sengetsu gakusei-no kaita sakubun-wa sugoku omoshirokatta
Last month student-GEN wrote composition-TOP very interesting
‘The composition that the student wrote last month was very interesting.’

![Fig. 2 Reading times of GEN-RC and NOM-RC](image2)

References

Many European countries use subtitles to broadcast foreign language (FL) films and TV programs as a cheaper alternative to dubbing. Furthermore, native language films and TV programs are often offered optionally with different language subtitles. Three different ways of subtitling exist and they vary in terms of whether the soundtrack and/or the subtitles are in the FL. With normal subtitling, native language subtitles are added to a FL soundtrack. With reversed subtitling, the soundtrack is in the native language and the subtitles are in a FL. In the case of intralingual subtitling, both soundtrack and subtitles are in the FL. One of the advantages of watching FL films with subtitles is the incidental learning of vocabulary and this has been investigated in a few studies. For example, Koolstra and Beentjes (1999) used a FL film with normal subtitles and found an increase in vocabulary learning compared to using a FL film with no subtitles. Similar results were found for reversed subtitles (D’Ydewalle and Van de Poel, 1999) and intralingual subtitles (Sydorenko, 2010). This seems to suggest that participants used the information in the subtitles to learn some vocabulary, but it remains unclear to what extent the subtitles are read. Therefore, although prior studies have investigated the use of FL films in the field of FL vocabulary learning, it remains necessary to ascertain first whether subtitles are read in all subtitling conditions as a first step to learning.

In the current study, the reading of the subtitles was investigated using normal (Dutch soundtrack and English subtitles), reversed (English soundtrack and Dutch subtitles) and intralingual (Dutch soundtrack and Dutch subtitles) subtitling conditions. Participants were native English speakers with no knowledge of Dutch and they watched 25 minutes of an animated film whilst their eye-movements were recorded.

The results revealed that when the soundtrack was in Dutch, participants read the subtitles whether they were in their native language or in the FL. Furthermore, participants spent a considerable amount of time reading the Dutch subtitles in the reversed condition even though they had no knowledge of Dutch and they did not need the subtitles to help them understand the film. No differences were found between the normal and intralingual conditions neither in terms of the total fixation duration nor the number of fixations in the subtitle area. An analysis of consecutive fixations in the subtitle area also revealed similar reading pattern between those two conditions.

In conclusion, the eye-tracking data suggests that the dynamic nature of the subtitles (their appearance and disappearance on the screen) coupled with the fact that they contained words, whether in a native or a foreign language, was enough to generate automatic reading behavior. The reading of the subtitles occurred even when the words were in a FL that was unknown to participants. As subtitles were processed to some extent in each subtitling condition, this seems to suggest that language learning using FL films with subtitles is plausible.
References:


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Bilingual word recognition has focused on the interaction between L1 and L2 representations during lexical access. It has been reported that words can be co-activated during the initial steps of lexical access whatever the language they belong to and that lexical access is therefore language nonselective. One aspect of lexical access in a second language (L2) that has not yet been studied is the precision of lexical orthographic representations, which can be conceived as a high quality of the representations of letters in the word, their identity and order associated with a fine-tuned orthographic coding mechanism.

This issue of the existence of L2 orthographic representations and their precision is of particular interest when investigating low-proficient bilinguals or young L2 learners who do not yet master the L2 and have a few exposure to the language. The masked priming paradigm has been shown to be a good tool for investigating orthographic representations and coding. Our goal was to use this paradigm to examine orthographic representations in L2 learners of varying language exposure. Particularly, we compared L2 target processing in three priming conditions: identity, form and unrelated priming. Identical priming (boat-BOAT) and form priming (doat-BOAT) effects have been shown to be facilitatory, respectively due to pre-activation of the lexical target representation and share of letters between the prime and the target (Pratarelli, Perry & Galloway, 1994). We suggest that precision of L2 orthographic representations can also be investigated by comparing identical and form facilitation priming effects. The rationale is that any priming difference that emerges between the two priming conditions should reflect good precision of L2 orthographic representations, that is sensitivity to the exact letter identity in the word. Oppositely, equal facilitation priming effects may reflect poorly specific lexical representations.

Two groups of French native speakers learning English as a L2 were examined: adult low proficient bilinguals and Grade 8 Secondary school children who have respectively been exposed to the English language for 7 and 2 years. This exposure condition enabled to test for developmental differences in the priming patterns. Seventy-two English (L2) target words were used in a lexical decision task. These target words were preceded by either an identical prime word (boat – BOAT), a form prime pseudoword (doat – BOAT) or an unrelated prime word or pseudoword (mice- BOAT). Written frequency, position of the letter change between the prime and the target and cross-language neighborhood were controlled. A lexical decision task associated with the masked priming procedure was used using a 57 ms SOA.

Results revealed no interaction between priming effects and level of L2 exposure, which led to combined analyses of the two groups of participants. Priming effects revealed a significant difference between orthographically related conditions (identical and form priming conditions) as compared to the unrelated priming condition, that reflected orthographic facilitation. Importantly, facilitation priming effects were stronger in the identical priming condition as compared to the form priming condition, which reflected sensitivity to one-letter difference between the prime and the target.

These results offer the first tentative support for the existence of identity and form priming facilitation effects in these populations of low-proficient L2 learners. They also evidence high precision of L2 orthographic representations in both groups of L2 learners and
so as early as after 2 years of L2 exposure. These results are discussed within the bilingual interactive activation framework (Dijkstra & van Heuven, 2002).

References:

Phonological and orthographic overlap effects in fast priming

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We used the fast priming paradigm to examine the influence of phonological and orthographic overlap between prime and target. We tested 4 types of overlap: (1) high-phonological high-orthographic end-overlap (P+O+: track-crack), (2) P+O+ begin-overlap (swoop-swoon), (3) low-phonological high-orthographic overlap (P-O+: bear-gear), and (4), high-phonological low-orthographic overlap (P+O-: fruit-chute). The primes and targets were controlled for length and frequency between the different types and the prime was always higher in frequency than the target. Before the eyes fixated on the target word, the target word preview consisted of a pronounceable non-word (qulk). When the eyes crossed an invisible boundary placed just before the target word location, the non-word changed to the overlapping prime word, which was presented for either 32 or 50 ms, before being replaced by the target word:

(1) Joshua picked up the\([\text{qulk (preview)} \rightarrow \text{bear (prime)} \rightarrow \text{gear (target)}]\) that he needed for his surfing trip.

Facilitatory priming single fixation and gaze duration effects were found for both P+O+ conditions at both prime durations, which did not differ from each other (though there was a slight numerical advantage for begin-overlap items). The single fixation duration analyses indicated that the priming effect was greater, and that the target word was read faster, when both phonology and orthography overlapped than when the overlap was only at the phonological or the orthographic level. Finally, when the overlap was only phonological, no priming was observed at the shortest prime duration. These results point to a substantially greater reliance on orthographic information during reading and indicates that conflicting phonological information can be easily ignored. At the same time, consistent phonological information can slightly boost recognition. We will discuss these results in light of previous fast priming results and recent models of word recognition (e.g., the bi-modal interactive activation model, Grainger & Holcomb, 2009).

Order of Acquisition in learning novel nonwords: A laboratory analogue of the AoA effect using eye-movements
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Background. Age-of-acquisition (AoA) effects refer to the general finding that words that are acquired earlier in childhood are processed more quickly and/or accurately than words that are acquired later in life (Juhasz, 2005). For example, there is evidence that early acquired words are fixated for shorter durations in reading (Juhasz & Rayner, 2006). However, it can be difficult to establish that such effects derive from AoA since AoA is correlated with other factors, such as frequency, imageability and word length. Recently, there has been a drive to simulate AoA effects in the laboratory [so-called Order-of-Acquisition (OoA) effects] by exposing adults to novel items, some presented early and others later in training (e.g. Izura et al., 2010; Stewart & Ellis, 2008). Such studies are often artificial, as participants are given explicit and intense training with these novel, sometimes meaningless, items. The present study aimed to simulate OoA effects more naturalistically by exposing adults to novel nonwords embedded in meaningful sentences. In addition, an eye movement paradigm was used. Unlike tasks used in previous OoA studies (e.g. reaction times in Izura et al., 2010) eye movement data have the potential to reveal how a variable’s effects unfold with learning.

Method. During a five-day exposure phase, participants read a series of English sentences which contained 16 nonwords. Each session lasted only five minutes to avoid effects of fatigue. Each nonword referred to an imaginary tool and was embedded in 15 different contexts (describing size, weight, shape etc. of the tool). Target nonwords were presented either early (starting on Day 1) or late (starting on Day 2) during this exposure phase with total exposure (i.e. cumulative frequency) held constant. Assignment of nonwords to the two conditions was counterbalanced across participants. Participants were not instructed to learn the target nonwords, and were not warned about the testing phase. Testing occurred on Day 5 and had two components: (1) participants’ eye movements were monitored as they read new sentences containing the nonwords (in neutral contexts), (2) an (unexpected) offline test of the novel word meanings (matching the novel words to a description of their function).

Results. Despite the absence of explicit training, OoA effects were observed both in the offline test and in eye movement measures: paired t-tests showed that participants showed better learning of the meanings of early-acquired nonwords, and these nonwords were fixated for shorter durations than late-acquired nonwords. Furthermore, participants who performed above chance in the offline task showed longer gaze durations (a relatively early measure of processing) on late than early-acquired nonwords, while participants performing below chance did not (see Figure 1). When analysed together, both groups showed longer total reading times (a late measure of processing) on the late than early acquired nonwords.
Discussion. To our knowledge, this is the first demonstration of OoA effects in the absence of explicit training, and within an eye-movement paradigm. The effect of OoA in an early eye movement measure (gaze durations) specifically for participants who showed good knowledge of the nonword meaning is in line with previous research which shows that gaze durations are sensitive to word recognition processes, including semantic activation (Juhasz & Rayner, 2003).

References


Words, words, non-words:
Learning a pseudo-lexicon during the first year of life
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It is widely assumed that during their first year of life, infants start to store word-forms using statistical learning. A straightforward consequence of this assumption is that besides real words, infants’ recognition ‘lexicons’ should contain a large number of non-words, consisting of mis-segmented but frequently occurring sound sequences. We offer experimental evidence for the existence of such a pseudo-lexicon in 11 month-old French infants, who recognize familiar disyllabic word-forms (Hallé & de Boisson-Bardies, 1994) while they are not yet capable of segmenting disyllables out of continuous speech (Nazzi et al., 2006). We ran three preferential looking experiments, including 16 infants each, with a visual fixation procedure. We found that infants indeed recognize frequently occurring sound sequences and that among those sequences they do not distinguish between words and non-words.

Using a corpus of speech addressed to infants under 2 years old, containing over 285,000 word tokens, we implemented a simple algorithm that extracts n-grams. In Experiment 1, infants were presented with lists of high- vs. low-frequency n-grams (see Table 1). All n-grams were phonotactically legal, but none of them were real words or phrases. Each infant heard six lists of each type. Each list contained a randomization of 12 n-grams. High- and low-frequency n-grams were matched pair-wise in syllable structure and did not differ in their mean bigram frequency. Infants listened longer to high-frequency n-grams than to low-frequency ones (see Figure 1; \( t(15) = 3.0; p < 0.01 \)). In Experiment 2, another group of infants listened to high-frequency n-grams of a somewhat lower frequency range vs. matched low-frequency n-grams. They did not have a preference for either of the list types (\( t(15) < 1 \)). In Experiment 3, a final group of infants listened to high-frequency n-grams (the same as in Experiment 1) vs. high-frequency real words (the ones that 11-month-olds were shown to recognize in Hallé & de Boysson-Bardies (1994)), which did not differ in their mean frequency. No difference in listening time was found (\( t(15) < 1 \)).

Together, these experiments show that before mastering word segmentation, French-learning infants build a rough approximation of a lexicon, by clustering the most highly frequent sound sequences. Our results allow us to assess the psychological plausibility of competing clustering algorithms. Specifically, they are more in accordance with an algorithm based on the transitional probabilities of syllables (as in Saffran et al., 1996), than with a more sophisticated algorithm relying on the mutual information of syllables (akin to the one used in Swingley, 2005); indeed, the former but not the latter is more likely to extract the high-frequency speech sequences used in Experiment 1. Thus, infants appear to follow a relatively simple strategy to extract potential word-forms from continuous speech. In line with these observations, we estimate that their pseudo-lexicon should contain between 1500 and 3000 forms, only 20 to 25% of which are real words. We discuss consequences of the early construction of a pseudo-lexicon for models of early language acquisition, specifically with regard to the interaction of phonological and lexical acquisition.
Figure 1. Mean looking times per condition in Exp. 1-3.

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<th>Experiment 1</th>
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Table 1. Lists of experimental stimuli. High-frequency n-grams from Experiment 1 have a frequency range within the top 0.5% of n-grams ranked by frequency, whereas those of Experiment 2 are between the top 0.5% and 1%. Low frequency n-grams are in the lowest 16% frequency range, corresponding to a mean number of occurrences of 1 in the corpus (the frequencies of n-grams show a decrease following a power law).

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The Nature and Interaction of Word-Learning Mechanisms Determine How Meanings are Represented

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People overcome the challenge of word learning in different ways. While there is some agreement regarding the importance of mechanisms such as cross-situational word learning (CSWL, Yu & Smith, 2007) and word learning based on the sentence context (sentence-level constraint learning, SLCL, e.g. syntactic bootstrapping, Landau & Gleitman, 1985), there is a lack of studies examining the exact interplay of these different ways of word learning. Moreover, there are few investigations of how different learning mechanisms may impact upon the way words are mentally represented and retained. One notable exception is the study by Vouloumanos (2008), which presented evidence for the hypothesis that CSWL proceeds probabilistically and in parallel (see also Yurovsky, Fricker, Yu, & Smith, 2010).

We investigated the nature and interaction of the two word-learning mechanisms – CSWL and SLCL – within a novel two-day experimental paradigm, teaching German adults a semi-natural language (modified Indonesian). Participants were first familiarized with a set of verbs (e.g., mankemema, ‘iron’): Actions were simultaneously depicted and named, participants were explicitly asked to memorize these mappings. To those participants who perfectly learned all verbs, 96 noun-learning trials were presented: Spoken SVO sentences, embedding 16 novel object nouns (e.g. si bintang, ‘the shorts’), were paired with scenes including potential referents. Nouns had two possible meanings (= referents). One co-occurred with the noun in 83% of the noun’s presentations, the other in 50%. That means that CSWL supported the 83% referent the most. Nouns followed either a restrictive verb (such as eat, Condition R) or a non-restrictive verb (Condition N). Restrictive verbs (together with the visual context and learner’s world knowledge), that is, SLCL, also supported the 83% meaning (Ex.1). Nouns were tested forced-choice directly following training and one day after: Either, the 83% object, the 50% object, and two distractors (17%) were selectable (Type 1); or, the 50% object, a category associate (17%) of the 83% object, and two distractors (17%) were depicted (Type 2).

We found that learning rates (83%-object choices in Type 1) were clearly above chance (25%) in both conditions (N: 60%, R: 84%). Moreover, learners were more likely to select the 83% referent in Condition R than N and more likely to select the 50% candidate in Condition N than R. Importantly, in Test Type 2, the 50% referent was preferred over the distractors in Condition N but not in Condition R. In Condition R, on the contrary, there was a clear preference to choose the category associate of the 83% referent. Results from the vocabulary test on Day 2 additionally reveal that learning rates in both conditions were still clearly above chance and only significantly worse than on Day 1 for Condition N.

These results suggest that SLCL (Condition R) completely blocks learner's sensitivity to low-frequency co-occurrence frequencies (83% vs. 50% and 50% vs. 17%), which is not the case for pure CSWL learning. In contrast, SLCL increased learners' sensitivity to category membership. This pattern confirms that while CSWL leads to parallel and probabilistic learning, SLCL is more deterministic and category-based. Finally, while both mechanisms give rise to long-term learning, SLCL learning appears more stable.
R: Si laki tambamema si bintang. 'The man irons the BINTANG.'
N: Si laki tambamema si bintang. 'The man takes the BINTANG.'
[shorts: 83%, apple: 50%, cheese: 17%, ananas: 17%]

References
Does learning in perception and production occur on different time scales?

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Building on the complementary learning systems model proposed by McClelland et al. (1995), recent work has suggested that aspects of lexical learning may take place on different time scales and may be differentially affected by consolidation, occurring during sleep (see Davis and Gaskell, 2009, for a review. This paper examines whether aspects of phonological learning also occur on different time scales. Specifically, I examine learning of novel sound categories in both perception and production.

The relationship of perception and production during learning is complex. For example, Leach and Samuel (2007) demonstrated that producing tokens during training disrupts aspects of lexical learning. In the phonological domain, Baese-Berk (2010) demonstrated that participants who repeated tokens during training of a novel sound contrast learned less in perception than participants who were trained in perception alone. However, the same participants who did not learn in perception demonstrate robust learning in production. This study aims to examine whether phonological learning in perception and production takes place over different time scales.

Methods: Native, monolingual English speakers were trained on stimuli re-synthesized from the speech of a single speaker along a continuum of pre-voiced to short lag alveolar stops. This training was implicit; participants were not given any explicit information about the number or type of categories they should be trying to learn (see Maye and Gerken, 2000, 2001, Hayes, 2003). Participants were divided into two training groups: Perception+Production, who repeated aloud tokens heard during training, and Perception-Only, who did not explicitly produce tokens and did not complete any other task during training.

After training, participants were tested on discrimination of within- and across-category contrasts and repetition of tokens representing the new contrast. Participants performed pre- and post-tests on each of two days of training. Perceptual Learning Results: At pre-test, there were no significant differences between the two training groups. After two days of training, participants in the Perception-Only group demonstrate robust significant improvement in their discrimination for pairs of tokens that fall across the two new categories, but not tokens that fall within a single category (See Figure 1). Participants in the Perception+Production group do not demonstrate significant improvement in their discrimination ability after two days (See Figure 2). When examining the time-course of learning, it is clear that participants in the Perception training group demonstrate small amounts of learning after one day of training. Furthermore, they make significant improvements in their discrimination abilities overnight (i.e., between Day 1 post-test and Day 2 pre-test).
Figures 1 and 2: Discrimination results for within and across category comparisons for the Perception-Only and Perception+Production training groups. Significant differences are starred.

**Production Learning Results:** Both training groups demonstrate learning in production after two days of training, as measured by changes in voice-onset time from pre- to post-test; however participants in the Perception+Production group change their productions more from pre- to post-test. However, neither group shows changes overnight in their abilities to produce tokens (See Figures 3 and 4).

Figures 3 and 4: Repetition results for within and across category comparisons for the Perception-Only and Perception+Production training groups. Significant differences are starred. The difference between tokens 1 and 8 at the Day 2 Post-test is larger for the Perception+Production training group than the Perception-Only group.

**Conclusions:** These results have significant contributions. First, the results provide evidence that aspects of phonological learning may take place over different time courses, possibly mirroring results in lexical learning (Davis and Gaskell, 2009). Second, they provide evidence that a complex relationship between speech perception and production exists, especially during learning. Follow-up analyses examine the learning patterns for participants trained and tested over three days to better understand the time-course of learning in each modality.

**References**


The grammatical gender effect in the picture-word paradigm depends on the specific properties of languages: Evidence from French

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Introduction. With the picture-word paradigm, different effects of grammatical gender have been observed, depending on language and task requirements. When bare noun production is required, an interference effect of gender congruency has been found in Italian and Spanish, but not in Dutch. Conversely, in determiner+noun production, a facilitation effect of gender congruency has been found in Dutch and German, but not in Italian and Spanish (Paolieri et al., 2010). Cubelli et al. (2005) assumed that in bare noun production the gender congruency effect is visible only in Romance languages, like Italian and Spanish, where nouns are marked for gender and nominal endings are chosen as a function of grammatical gender. Similarly, Miozzo and Caramazza (1999) proposed that in noun phrase production the gender congruency effect appears only in Germanic languages, like German and Dutch, where the definite determiner is specified uniquely by the nominal gender, and not by the phonology of the noun. To ascertain whether the grammatical gender effect reflects the distinction between Romance and German languages, we tested French speaking participants. In French the gender effect has not been found in noun phrase production (Alario & Caramazza, 2002), but it has never been investigated in bare noun production. If speakers of Romance languages (i.e. languages with most nouns with arbitrary grammatical gender because of the absence of the neuter gender) show the same behavior, a grammatical interference effect in bare noun production should be found also in French. However, in French, as in other Romance languages, the selection of the determiner depends on both the grammatical gender and the phonological form of the following noun, but, at variance with Italian and Spanish, nouns have neither gender-marked suffixes nor a clear mapping between phonology and gender. Therefore, if grammatical gender effect depends on the specific properties of languages, French speakers should show no difference between responses to congruent and incongruent target-distracter pairs in both bare noun production (like in Italian and Spanish) and noun phrase production (like in German and Dutch).

Method. Overall 48 students of the University of Provence Aix-Marseille participated, 24 in the Experiment 1 (bare noun production) and 24 in the Experiment 2 (noun phrase production). From Lotto et al. (2001) and Snodgrass et al. (1980), 40 pictures were chosen as targets, half with masculine names and half with feminine names. In both experiments participants were presented with a target picture coupled with a distracter word printed on it and were required to name the picture either by providing the bare noun (Experiment 1) or by providing the name preceded by the definite article (Experiment 2). The gender of the distracter word could be either congruent with the gender of the target name or incongruent. The target and distracter nouns were matched for noun frequency, length, number of phonemes, age of acquisition, name agreement and familiarity (Alario et al., 1999; New et al., 2004).

Results and Discussion. For both experiments, separate analyses were carried out on RTs with grammatical gender (congruent vs. incongruent) and target type (masculine vs. feminine) as factors. Only a main effect of target type (feminine nouns faster than masculine ones) was found in both experiments. Neither the effect of gender congruency nor the interaction reached significance. A-priori power analyses demonstrated that the number of both participants and items was large enough to detect a large effect size (.35) with a high
power (> .80), according to the criteria proposed by Cohen (1988). Thus, the absence of the gender congruency effect cannot be attributed to the lack of power of our design. The absence of the gender congruency effect in both bare noun and noun phrase production suggests that this effect depends on the specific characteristics of French which is similar to Italian and Spanish for the role of phonology in the determiner selection and to Dutch for the morphological structure of nouns, lacking gender marked suffixes.

References


Detecting inherent bias in the lexical decision task
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A basic assumption of the lexical decision task is that a correct response to a word requires access to a corresponding mental representation of that word. However, systematic patterns of similarities and dissimilarities between words and nonwords can introduce an inherent bias for or against a particular response to a given stimulus (e.g., word-stimuli can contain more vowels, nonword stimuli may frequently end with the same letter, etc.). When participants become aware of such a bias, for instance through implicit learning processes, reaction times may be affected and, most importantly, responses for particular stimuli may be guessed without requiring lexical access. We present a simple algorithm based on the Levenshtein Distance (LD) and one-nearest-neighbor classification (1NN) that can be used to derive the response bias for each stimulus in an experiment from the distribution of word and nonwords among the most similar previously presented stimuli. First, we will show that LD1NN is very sensitive to differences between words and matched nonwords generated according to different principles (i.e., random nonword generation, letter replacement, and various statistical pseudoword generation methods). Then, we will show that participants exhibit similar sensitivity by examining trial-level participant data from the English Lexicon project (Balota et al., 2007), the French lexicon project (Ferrand et al., 2010) and the British Lexicon project (Keuleers et al., in press). We will show that the algorithm's predicted biases for and against responses correspond to respectively faster and slower behavioral responses to stimuli. Finally, we will demonstrate how the LD1NN algorithm can be used to examine and limit the degree of inherent bias when designing an experiment and to control for existing bias in the statistical analysis of lexical decision data. The algorithm is described in Keuleers & Brysbaert (2011) and is freely available in the vwr library for R (Keuleers, 2011).
Figure 1. Sample output of the LD1NN algorithm presented with the stimuli presented to a random participant in the French Lexicon project. Left panel: distribution of word bias for both words and nonwords generated with a statistical matching procedure. Right panel: cumulative average of word bias for words and nonwords; the grey line indicates the numerical bias for words based on the percentage of words vs. nonwords processed up to that point.

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On the relevance of response relevance: Investigating semantic interference with conditional naming

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There is a recent debate on the question whether semantic interference effects in language production reflect competitive processes at the level of lexical selection (lexical competition hypothesis; e.g. Levelt, Meyer, & Roelofs, 1999) or whether they reflect a post-lexical bottleneck, to which response-relevant distractor words have preferential access (response exclusion hypothesis, REH; e.g. Mahon, Costa, Peterson, Vargas, & Caramazza, 2007). To investigate response relevance and its contribution to interference effects we combined a picture-word-interference (PWI) paradigm with a conditional naming procedure, in which object naming is conditional on a pre-specified criterion. Participants were instructed to name only objects that are typically seen in or on the water (e.g. canoe) and refrain from naming objects that are typically located outside the water (e.g. bike), and vice versa. All object pictures were presented with superimposed categorically related or unrelated distractor words. Categorical relatedness and response relevance of the distractor words were manipulated orthogonally such that related and unrelated words could be response relevant or irrelevant, as specified by the conditional naming criterion. For instance, when naming was conditional on objects being located in or on the water (e.g., target: carp) related distractors could be response relevant (herring; located in the water) or irrelevant (gecko; typically located outside the water); likewise, unrelated distractors could be response relevant (kayak) or irrelevant (train). Each distractor word appeared in all relatedness and relevance conditions.

In general, response relevance and semantic similarity in PWI experiments are difficult to disentangle and interference effects may be due to either of these two factors. Because the conditional naming criterion is based on a semantic attribute (typical place of occurrence in the real world), response relevant words are likely to have a closer semantic relation to the targets than irrelevant words that don’t share the relevant attribute and associated semantic features. To disentangle the effects of response relevance and semantic similarity, we included semantic similarity ratings (provided by ten participants, who did not take part to the actual experiment) of all target – distractor pairs. Furthermore, we included a free naming task (the classic task in most PWI experiments) in which all presented pictures should be named. Because in free naming all pictures are named, the factor “response relevance”, as defined by the conditional naming criterion, is irrelevant in this task. Therefore, any differences between the distractor “relevance” conditions that are present in the free naming task can be attributed to other factors, and most likely be attributed to differences in semantic similarity.

Predictions
Assuming that response relevance is the critical factor to observe semantic interference effects while semantic relatedness yields facilitatory effects arising at the lexical level (e.g. Mahon et al., 2007), response relevant distractors should delay naming latencies relative to irrelevant distractors. However, this effect should only be found in the conditional naming task and not in the free naming.

In contrast, if similar semantic interference effects emerge in both tasks, and furthermore, these effects increase with increasing semantic similarity (assessed by semantic rating), this would support the idea that response relevance effects actually reflect differences in the semantic distance between target and distractor. This pattern of results would be compatible
with the hypothesis that semantic interference is the product of competitive mechanisms during lexical selection.

**Results**

*Semantic similarity ratings*

ANOVA of semantic similarity ratings revealed not only that related distractors are rated as semantically more similar to the target than unrelated distractors, but also, that relevant distractors are rated as more similar to the target than irrelevant distractors (see Figure 1).

*Reaction times (RTs)*

Analyses of RTs were conducted with a linear mixed model procedure with predictors relatedness, relevance, task, and semantic similarity rating as continuous predictor. As can be seen in Figure 1, semantic interference effects are present in both tasks. Furthermore, relevant distractors induce longer naming times than irrelevant distractors and this as well, in both tasks. The analysis revealed main effects of task and semantic similarity but no effects of relatedness and relevance. Thus, semantic similarity accounts for all interference effects in both tasks.

**Conclusions**

The present results revealed no evidence for response relevance as a major source of semantic interference effects in the PWI paradigm. In contrast, our data demonstrate that semantic similarity, rather than response relevance, is critical for interference effects to be observed. These findings provide support for the lexical selection by competition hypothesis.

![Figure 1. Effects of distractor relatedness and response relevance in the conditional naming task (left), the free naming task (middle), and the results of the semantic similarity rating (right). Note that the factor response relevance is only applicable in the conditional naming task.](image)

References:


Focus Facilitation and Non-associative Sets
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One of the primary challenges for interpreting prosodic phenomena is determining the meaning of contrastive focus. Contrastive focus is frequently analyzed as introducing into a derivation other constituents that may serve as alternatives to a contrastively focused constituent (c.f. Rooth 1992). For instance, in ex. (1) below, Jane is contrastively focused so in the alternative semantic meaning, the subject of the sentence is a variable that must be a member of a set of individuals, C.

1) Jane loves Mark.
   a) ordinary semantics: \( \exists x \exists y. x = Jane \land y = Mark \land \text{loves}(x,y) \)
   b) alternative semantics: \( \exists x \exists y. x \in C \land y = Mark \land \text{loves}(x,y) \land C = \{ Jane, Sue, Amy \} \)

There is past experimental work showing that contrastively focusing a constituent makes it easier to access salient alternatives to that constituent. Kim et al 2010 used an eyetracking study to show that participants could disambiguate a target word from a cohort competitor faster when the target word was preceded by 'only' or 'also.' Norris et al 2006 and Braun & Tagliapietra 2009 both used cross modal priming studies to show that participants access alternatives to a contrastively focused prime faster than non-alternatives. However, the experimental evidence showing whether alternatives to a focused constituent are cognitively real is still quite limited.

Purpose: The current study has two purposes: 1) Provide evidence for alternative semantics by showing that alternatives to a contrastively focused prime are more salient than non-alternatives. 2) Investigate whether words that are not semantic associates can be in the set of alternatives.

Method: Participants (n=42) were shown four sentences, one at a time, and then a target word in a lexical decision task. The first sentence ended in a list of three items: the target word, an associate of the target word, and a non-associate of the target word. An associate was a common response to a cue word (see Nelson et al 1998’s norms). A non-associate was never a response to a cue word. The second sentence assigned a common property to the list. The third sentence began a short narrative, and the fourth sentence ended in the associated word, the non-associated word, or an unmentioned, unassociated word. This last word was focused with the word ‘only’ on half of the trials. This made for six conditions. (See example item below.)

The target word for an item was kept constant across conditions so that potential differences wouldn't favor one condition. The associated word, the non-associated word, and the unmentioned word were all matched for frequency within an item. Across the experiment, including fillers, participants saw as many real words as non-words.

2) Example Item: Rose lives to search old tombs, temples, and graves. She studies these as an archeologist. This year, she couldn’t find very many new sites. The whole year she searched...

   Focused associated: …only a grave.       Unfocused associated: …a grave.
   Focused unassociated: …only a temple.   Unfocused unassociated: …a temple.
   Focused unmentioned: …only a palace.    Unfocused unmentioned: …a palace.

   Target: tomb
Results and Discussion: Participants were faster to recognize the target as a word when the prime word was preceded by the focus particle 'only' (p<.05, F1=6.62, F2=4.53) even though this study relied on silent prosody (Fodor 1998, 2002). This is further evidence that sets of alternatives are actually considered by speakers when they hear a contrastively focused word and that previous results were not just a reaction to additional salience upon hearing an accented word. Additionally, the non-associated words were able to prime the target word in both the focused and the unfocused conditions (focused: p<.05, t1=-3.2, t2=-2.2; unfocused: p1<.05, t1=-2.1, p2=.067, t2=-1.8). Other work (McKoon & Ratcliff 1979) has shown the importance of episodic memory; this study shows that episodic information is also considered when composing a set of alternatives for a contrastively focused constituent. There is some slight ambiguity with this result though as priming was determined by comparing the non-associated conditions with the unmentioned conditions which, in addition to being unrelated, were also not given. Therefore, it should also be mentioned that the focused unassociated condition was marginally faster than the unfocused unassociated condition (p1=.076, p2=.097; t1=-1.8, t2=-1.6). This further shows that participants are included unassociated items in their list of alternatives for a focused constituent.

Works Cited


