Prosody makes good-enough representations better (or worse?)

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Christianson, Hollingworth, Halliwell and Ferreira (2001) [CHHF] found that readers who misparsed sentences with a temporary NP/Z ambiguity (2) frequently retained their original misanalysis, even when they had successfully reanalyzed the sentence. CHHF's perceivers incorrectly answered "yes" to questions like (5) more frequently following garden-path sentences (2) than following unambiguous sentences (1). The authors argued that the processor frequently fails to reanalyze completely, instead constructing a representation that is possibly ungrammatical but "good enough" for comprehension.

The present experiment attempted to replicate CHHF using spoken stimuli. We recorded 24 of CHHF's sentences, twelve with optionally transitive (OPT) (6) and twelve with reflexive absolute transitive (RAT) (2) verbs in four conditions. In the baseline condition, the unambiguous sentence (1) was produced with no major prosodic boundaries. The neutral-prosody condition also contained no major boundaries but the clauses appeared in the garden-path order (2). The remaining two conditions presented the garden-path sentence with prosody manipulated similarly to Kjelgaard & Speer (1999) [K&S]: helpful prosody contained a major prosodic boundary after the subordinate-clause verb (3), and misleading prosody had an infelicitous boundary after the ambiguous noun phrase (4). Thirty-three participants listened to the sentences and 60 unambiguous fillers, answered a comprehension question (5) for each, and rated their confidence in their answer on a scale of 1 to 4.

Collapsing across all four conditions, the rate of incorrect "yes" responses was significantly higher for OPT verbs (49%) than for RAT verbs (17%) ($t1(262)=8.3,p<0.001$; $t2(94)=7.1,p<0.001$). In considering the effects of the prosodic manipulations, the error rate for the unambiguous condition is the baseline, since a garden-path is unlikely in this condition. For OPT verbs, planned comparisons revealed that the error rate for the misleading condition was significantly higher than the baseline ($t1(96)=2.4,p<0.05$; $t2(33)=2.4,p<0.05$). For RAT verbs, the error rate was greater than the baseline for sentences with neutral prosody ($t1(96)=2.6,p<0.05$; $t2(33)=2.8,p<0.01$) and for sentences with misleading prosody ($t1(96)=5.3,p<0.001$; $t2(33)=5.9,p<0.001$). Furthermore, misleading prosody led to a significantly higher error rate than neutral prosody ($t1(96)=2.7,p<0.01$; $t2(33)=3.1,p<0.01$). In contrast, the error rate for sentences with helpful prosody was no higher than the baseline. There was no evidence of a difference in confidence ratings in any condition.

The results lead to two important conclusions. The first is that not all apparent failure-to-reanalyze effects represent retention of an earlier misanalysis. For OPT verbs, listeners' rate of "yes" responses was no higher in the neutral-prosody garden-path condition than in the unambiguous condition (contra CHHF, who found an effect of clause order), suggesting that the responses were not the result of misparsing the intransitive verb as transitive. However, the results from the misleading condition and from RAT verbs point to our second conclusion: not only can prosody help the processor avoid misanalysis (cf. K&S), but it can also impede successful reanalysis of a misparsed sentence. Clearly a sentence's prosody plays an important role in thematic role assignment and reassignment.

Examples

1. The baby spit up on the bed while Anna dressed.   (*unambiguous, neutral prosody*)

2. While Anna dressed the baby spit up on the bed.   (*neutral prosody*)

3. While Anna dressed ^ the baby spit up on the bed.   (*helpful prosody*)

4. While Anna dressed the baby ^ spit up on the bed.   (*misleading prosody*)

5. Did Anna dress the baby?

6. While the man hunted the deer ran into the woods.

Table 1. Proportion of incorrect "yes" responses to comprehension question

	unambiguous	*neutral*	*helpful*	*misleading*	*mean*
RAT verbs	0.06	0.20	0.05	0.36	0.17
OPT verbs	0.42	0.51	0.43	0.59	0.49

The temporal availability of distinct prosodic cues during sentence comprehension – ERP evidence from German RC attachment

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Numerous recent studies have demonstrated that overt prosody affects the interpretation of ambiguous sentences. For example, it was shown that differences in prosodic phrasing, as well as variances in pitch accent placement may have an impact on resolving so-called *RC attachment ambiguities,* where a complex DP is followed by a relative clause. More specifically, production data in Croatian (Lovrić, 2003), Hebrew (Shaked et al., 2004), and German (Augurzky et al., 2004) demonstrated that prosodic phrasing is influenced by the presence or absence of a preposition within the complex matrix DP. These prosodic differences were shown to affect auditory comprehension (Lovrić, 2003; Clifton, Carlson & Frazier, 2002). Moreover, the occurrence of pitch accents at distinct sentential positions was also observed to influence attachment preferences (Schafer et al., 1996; Maynell, 1999): When one of the matrix DPs is accented, it is preferably modified by a relative clause.

However, it is still unknown at which processing stages these different pieces of prosodic information determine interpretational processes. For example, it might turn out that phonological phrasing immediately contributes to the initial phrase structural organization in a sentence. By contrast, higher-level discourse structural mechanisms like focal accentuation might rather constrain the ultimate interpretation.

In order to address these issues, we carried out two studies using event-related potentials (*ERPs*). Both experiments explored whether prosody influences the initial structural commitment directly on the position of the attachment, i.e. on the relative pronoun. The experimental factors PREPOSITION (no preposition vs. *von*), FORCED ATTACHMENT (high vs. low by gender agreement of one of the DPS with the relative pronoun), and PROSODY (high attachment prosody vs. low attachment prosody) were manipulated.

Experiment 1 examined the effect of prosodic phrasing on attachment. Contrary to results from silent reading (Augurzky et al., 2005), we observed that overt prosodic phrasing has an immediate impact on RC attachment resolution. Moreover, the prosodic influence was tightly connected to the phrase-structural contrast between genitives and *von*-DPs, suggesting an early interactive processing of phonological and phrase-structural information in the auditory domain. When there was a mismatch between phrase-structural information and prosodic realization, a negative-going deflection for high attachment indicated an early low-attachment advantage, analogous to the visual domain. By contrast, when there was a match between the two domains, no ERP difference between high and low attachment was found, indicating that a felicitous combination of both information types can override attachment preferences.

Experiment 2 explored the impact of pitch accent placement on attachment while prosodic phrasing was held constant. Contrary to *Experiment 1*, no immediate effect of prosody on ambiguity resolution was found. A low-attachment advantage was observed in any condition: Regardless of the prosodic contrast and the presence or absence of a preposition, a negativity reflected an enhanced processing cost for high attachment.

In sum, our results indicate that phonological phrasing plays an immediate role in the on-line resolution of ambiguous structures during adjunct processing. By contrast, higher-level discourse prosody does not influence the initial attachment, but is restricted to later processing stages.

Stimuli tested in *Experiment 1*

(1) a.   Das ist die Nachbarin # des Dichters (/von dem Dichter) deren / dessen Vogel pausenlos zwitscherte.

   b.   Das ist die Nachbarin des Dichters (/von dem Dichter) # deren / dessen Vogel pausenlos zwitscherte.

   This is the neighbor$_{FEM}$ the poet$_{MASC}$ (/ of the poet$_{MASC}$) whose$_{FEM/MASC}$ bird permanently chirped

   "This is the neighbor of the poet whose bird was permanently chirping."

Stimuli tested in *Experiment 2*

 (2) a.   Das ist DIE Nachbarin des Dichters (von dem Dichter) deren / dessen Vogel pausenlos zwitscherte.

   b.   Das ist die Nachbarin DES Dichters (von DEM Dichter) deren / dessen Vogel pausenlos zwitscherte.
   This is the neighbor$_{FEM}$ the poet$_{MASC}$ (/ of the poet$_{MASC}$) whose$_{FEM/MASC}$ bird permanently chirped

Advances in prosodic annotation: A test of inter-coder reliability for the RaP (Rhythm and Pitch) and ToBI (Tones and Break Indices) transcription systems

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This paper reports results from a large-scale inter-coder reliability study evaluating two intonational coding systems: ToBI (Tones and Break Indices) (Silverman, et al. 1992), and RaP (Rhythm and Pitch) (Dilley & Brown, 2005). There have been limitations with previous evaluations of ToBI including, most importantly, a small corpus of speech, (e.g. Pitrelli, et al., 1994), or a small number of coders (e.g. Yoon, et al., 2004; Syrdal & McGory, 2000). There have been no inter-coder reliability evaluations of the RaP system to date. The current paper seeks to fill this gap in the literature.

For the current study, we selected 14.4 minutes of speech: 6.2 minutes of spontaneous speech from the Call Home corpus; 8.2 minutes of read speech from the Radio News Corpus. Both the spontaneous speech and the read speech divisions contained utterances produced by six different speakers, for a total of twelve speakers in the corpus. Each file in the corpus (varying in length from 30-60 seconds) was coded by a minimum of 4 and a maximum of 7 expert coders using both the ToBI conventions and the RaP conventions, for a total of 28.8 minutes of coded data.

The ToBI system is based on the prosodic theory developed by Pierrehumbert (1980). ToBI labels consist of a break index after every word, indicating the sense of disjuncture between words. In addition, utterances are divided into phonological phrases (~every 5-10 words) depending on disjuncture and tonal movement. Finally, every phase contains one or more pitch accents, depending on perceived prominence. Pitch labels are non-locally defined.

RaP transcriptions, like ToBI transcriptions, also consist of the division of utterances into phonological phrases, and the indication of pitch accents. However, RaP indicates pitch accents only in cases where an audible local pitch excursion obtains on a given syllable. A further difference in the two systems is the fact that RaP requires the labeling of every local pitch change. Furthermore, RaP attempts to capture the sense of speech rhythm by including markers on every rhythmically prominent syllable in an utterance (~every 2-3 syllables). Finally, RaP labels attempt to capture prosodic parallelism—places where a particular tonal and rhythmic pattern is repeated.

The paper will present agreement statistics for the following categories: (1) ToBI: (a) Location and type of boundary tone (L% or H%); (b) Location and type of phrase accent (L-, H- or !H-); (c) Location and type of pitch accent (L*, H*, L+H*, H+!H*, L+!H*); (2) RaP: (a) Location of phrase boundary; (b) Location of metrical prominence; (c) Location and type of pitch accent (H*, L*, E*); (d) Location and type of pitch labels (H, L). For example, we compared 25,532 pairwise coder comparisons on syllables in the RaP codings and found that (a) 90.2% of the time 4 coders agree whether or not a syllable is metrically prominent, and (b) 66.3% of the time 4 coders agree on a specific pitch label for a syllable, among three choices. Similar analyses will be presented for all categories of the RaP and ToBI systems.

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The given-new distinction: How context and definiteness impact referential interpretation

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Referential interpretation of determiner phrases (DPs) can either result from the formation of a dependency relation (with a previously introduced referent) or from the establishment of an independent discourse referent. The exact nature of referential interpretation is constrained by distinct linguistic information such as contextual salience or definiteness marking. The present experiment investigated how these two sources of information affect sentence comprehension. The time course of referential interpretation was examined by means of event-related potential recordings (ERPs) in a reading experiment in German.

In German, definiteness marking provides a cue to referential interpretation. An indefinite determiner (*ein(en) Redner*, 'a speaker') generally serves to introduce a new discourse referent, and a definite determiner (*der Redner*, 'the speaker') signals that the DP refers to familiar information, which either results in coreferential interpretation (i.e. identity (1A)) or in inferentially licensed interpretation (so-called 'bridging inference' (2A)).

Contextual information also guides referential interpretation by influencing the familiarity of a DP. The identity-supporting context (1) introduces the critical DP *einen Redner* to license an identity relationship in the target sentence. In the inference-inducing context (2), the DP *einen Vortrag* is introduced that serves as a salient anchor for the critical DP, yielding an inferentially licensed dependency of the sort 'the speaker at the talk Tanja visited'. Following the novelty-supporting context (3), a new discourse referent must be created, but note that the mini-discourse appears relatively incoherent.

The ERP study was conducted to investigate referential interpretation as a function of the given-new distinction. The factors CONTEXT (identity-supporting/inference-inducing/novelty-supporting) and DEFINITENESS (definite/indefinite) were crossed yielding 6 context-target sentence pairs illustrated below. Dependency formation is available for (1A/2A), while the DPs in the other conditions introduce an independent referent by means of indefinite marking (1-3B) or in the absence of an anchor in previous discourse (3A). Moreover, the definite DP in (2A) forms an inferential dependency *and* introduces an independent referent. In the indefinite conditions (1B) and (2B), lexico-semantic information is activated despite the predicted absence of coreferential dependency (yielding priming). Dependency formation was predicted to surface as reduced N400 based on findings from antecedent/repetition priming (Rugg, 1985). A modulation of the N400 was generally expected to reflect the impact of the factor CONTEXT (Kutas & Federmeier, 2000). Cost arising from the integration of independent discourse referents was predicted to emerge as P600 (Burkhardt 2005).

The results indicate that distinct neural mechanisms are observable during referential interpretation. Givenness – along with coherence – correlated with a reduction of the N400: the effect of CONTEXT was modulated in the N400 regardless of the factor DEFINITENESS (1<2<3), confirming that lexico-semantic information plays a prominent role in online sentence processing and countering strict accounts of givenness=definiteness. Newness elicited a pronounced P600, which was registered for all DPs requiring an independent representation, triggered by either indefiniteness (1B/2B/3B) or absence of a matching antecedent (2A/3A). These findings suggest that the given-new distinction has electrophysiological correlates with CONTEXT being more powerful than DEFINITENESS: the N400 reflects contextual cuing, while the P600 indexes cost from the introduction of new referents triggered by context *and* (in)definiteness.

Examples

| 1. Identity-supporting Context: | Sandra besuchte neulich einen Redner in Jena. |
| | *Sandra visited recently a speaker in Jena.* |

| 2. Inference-inducing Context: | Tanja besuchte neulich einen Vortrag in Berlin. |
| | *Tanja visited recently a talk in Berlin.* |

| 3. Novelty-supporting Context: | Laura begegnete Tim ganz zufällig in München. |
| | *Laura met Tim accidentally in Munich.* |

| Target Sentence A/B: | Sie berichtete, dass DER REDNER / EIN REDNER sehr beeindruckend wirkte. |
| | *She reported that THE SPEAKER / A SPEAKER appeared very impressive.* |

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Pitch accents affect ambiguity resolution

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Prosodic boundaries clearly influence sentence processing (e.g., Lehiste 1973, Price et al. 1991, Speer et al. 1996, Carlson et al. 2002, Watson & Gibson 2003), especially the attachment of constituents. Effects of pitch accents on sentence interpretation are less common (though see Schafer et al. 1996, 2000, Carlson 2001, etc.), as pitch accents are more tied to information structure and discourse-level sentence properties. But in the right circumstances, such as structures expressing contrast, we propose that pitch accents should strongly affect interpretation decisions. In three auditory studies of English replacive sentences, prosodic boundaries were overwhelmed by recency, but pitch accents remained effective.

Experiment 1, an auditory acceptability study, tested the four conditions in (1), varying the presence of a major prosodic boundary (an Intonational Phrase, or IPh). The intended contrast of the replacive phrase (*not Louisa* or *not the soundtrack*) was disambiguated by animacy and plausibility. On the theory that prosodic phrases organize input in memory during parsing (Speer et al. 1996), we hypothesized that an IPh boundary between the early clauses (1a/c) would make the matrix subject (*Diane*) even less accessible as a contrast than it already was due to distance. The *soundtrack* conditions were accepted more readily than the *Louisa* conditions (90% acceptable ratings vs. 66%), showing a general preference for the closer contrast. The boundary manipulation, however, had no effect, contrary to our hypothesis. Experiment 2, an auditory questionnaire, tested ambiguous sentences like (2) with either one or two IPh boundaries (placed as in (1)). A strong preference for the embedded subject contrast (90%) was the only result, replicating Experiment 1.

Experiment 3, another auditory questionnaire, then varied the type and position of pitch accents in ambiguous replacives as in (2). Conditions (a-b) placed contrastive (L+H*) pitch accents on the replacive and one of the prior arguments, in order to highlight the interpretation in which they contrasted. Condition (c) had non-contrastive (H*) accents on all three arguments. Condition (a) received 30% matrix responses, while condition (b) received 11% and condition (c), 14%. So contrastive accentuation of the matrix subject (a) produced significantly more matrix contrasts, though accenting the favored embedded subject (b) had little effect compared to the neutrally-accented baseline (c).

Overall, the matrix subject was a dispreferred contrast for the remnant, regardless of whether it was in the preceding prosodic phrase or a more distant one. This may reflect a preference for attaching the remnant phrase to the closer clause. But accenting the matrix subject significantly increased the proportion of matrix responses. We suspect accent position has this effect because replacive sentences are an ellipsis type in which a single phrase syntactically contrasts with a prior sentence constituent; therefore, accents indicating a particular contrast can influence interpretation. Pitch accents will not always have stronger effects on interpretation than prosodic boundaries, but they do in replacive sentences. They also bias the interpretation of focus-sensitive ellipsis sentences (Frazier & Clifton 1998), relative clause attachment (Schafer et al. 1996), and embedded questions (Schafer et al. 2000), among other structures.

Examples

(1)   Diane thought   that the movie was well-edited,   not {Louisa/the soundtrack}.

a/c. L+H*   IPh   H*   IPh   L+H* /   L+H*
b/d. L+H*   H*   IPh   L+H* /   L+H*

(2) Diane thought Patrick was entertaining, not Louise.

a. L+H*   IPh   L+H*
b.   L+H*   IPh   L+H*
c.   H*   H*   IPh   H*

Early and late preferences in relative clause attachment in Brazilian and European Portuguese

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Studies of the relative clause (RC) attachment ambiguity have found that preferred interpretations of the RC in (1)—whose subject could be coindexed with either the higher (non-local) noun, *convidados*, or the lower (local) noun, *professoras*—vary not only cross-linguistically but also depending on details of the materials and the methodology employed to determine preference. Both Brazilian (BP) and European (EP) Portuguese can be classified as high attaching, the preference determined via questionnaire instruments (Maia et al., 2005, among others) or self-paced reading tasks exploiting pragmatic information to disambiguate attachment (Ribeiro, 2001). However, the first study of this construction in Portuguese (Miyamoto, 1999) found a preference for low attachment, with a self-paced reading task using materials disambiguated by number agreement. Miyamoto (2005) has argued that his earlier results may have been confounded by an artifact related to the number agreement manipulation: the configuration in which a forced high attachment contains an intervening plural noun (e.g., *o convidado das professoras que cantava*, 'the guest of the teachers who sang[3sg]') could be the source for the longer reading times observed with forced-high materials. Alternatively, the facts for Portuguese suggest a time-course for processing this construction not unlike that observed for Italian (De Vincenzi & Job, 1993) and for Spanish (Fernández, 2003): early attachments are low, following locality preferences, but may later be revised to high as the parser considers extra-syntactic information. We support this alternative interpretation with data comparing preferences in BP and EP.

In a self-paced reading experiment, we presented materials like (2), RC's attachment disambiguated to the high (*convidados*) or low (*professoras*) noun by number agreement. The RC verb was systematically plural, the two nouns in the complex NP mismatched in number. (Crucially, our materials avoid the configuration in which a forced-high attachment contains an intervening plural noun.) Participants read materials segmented into two regions (indicated by the slash), and answered a comprehension question probing the correct interpretation of the RC (e.g., *Quem cantava?* 'Who sang?'). The second frame, where attachment is disambiguated, was read 353 ms faster with forced-low (2b) than forced-high materials ($F1(1,72)=12.22$, $p<.001$; $F2(1,44)=7.26$, $p<.01$), an effect present in both BP and EP (BP-EP difference: $F1,F2<1$; interaction: $p>.15$). In contrast, and arguably reflecting later phases of processing, errors on questions following target sentences were reduced with forced-high (12.5%) compared to forced-low (22.9%) materials ($F1(1,72)=21.59$, $p<.001$; $F2(1,44)=12.66$, $p<.001$), in both BP and EP (interaction: $p>.05$). The two linguistic varieties differed in only one respect: overall error rates were higher for BP (22.9%) than EP (12.5%) speakers ($F1(1,72)=15.84$, $p<.001$; $F2(1,44)=50.00$, $p<.001$), an effect in line with observations (e.g., Galves, 1993) that the representation of agreement is in the process of weakening in BP.

Attachment preferences, similar across BP and EP, reflect the operation of sentence processing routines: early low attachments may later be revised to high when the sentence is integrated within the available discourse. The only emerging difference between BP and EP most plausibly reflects a difference in the internalized grammars of the two varieties of Portuguese.

Examples

1. O Alexandre fotografou o convidado da professora que cantava.
    '[Det] Alexander photographed the guest of the teacher who sang[3sg]'

2. a. O Alexandre fotografou / os convidados[pl] da professora[sg] que cantavam[3pl].
    b. O Alexandre fotografou / o convidado[sg] das professoras[pl] que cantavam[3pl].

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Beyond accessibility: Topichood and production

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A speaker is faced with different syntactic options when producing a sentence, such as the active ("the traffic aggravated the driver") versus the passive voice ("the driver was aggravated by the traffic"). Previous research has shown that there are a number of different factors that influence speakers' choices of syntactic structures. Cowles and Ferreira (2002) found that one such factor is the topic status of a given referent, with linguistic arguments that are previously mentioned as topics being especially likely to be mentioned early in subsequent utterances. What remains unclear is how topic status exerts an influence on the production system. One possibility is that this influence can be reduced to effects of accessibility: topic status leads to an increase in accessibility, which in turn affects the production system in the same way as other accessibility-based influences (e.g. previous mention). Another possibility is that topic status has a more direct influence on the sentence production system itself, perhaps prompting alignment within and across speakers (e.g. Pickering & Garrod, 2004) at the level of information structure.

We tested these possibilities using materials from Cowles & Ferreira (2002) in a single experiment with two tasks: sentence production and lexical decision. In all trials speakers heard a setup sentence that established either a theme or experiencer noun as topic (mentioning it in an 'about' phrase: "The passenger noticed something *about the traffic/driver*") or as given (mentioning it in an adjunct clause: "The passenger noticed something *when he saw the traffic/driver*"). In half of the trials, speakers performed the sentence production task: after the setup sentence they saw a verb ("aggravated") and the two nouns ("traffic" and "driver", order of presentation was counter-balanced), which they formed into a target sentence related to the just-heard setup sentence. We measured how often the theme noun was mentioned before the experiencer in the target sentence ("The traffic aggravated the driver"). In the other half of the trials speakers performed the lexical decision task: instead of three words, speakers saw only the theme ("traffic") after they heard the setup sentence and were asked to decide whether it was a real word. Speakers did not know which task they would need to perform until the prompt (one vs. three words) appeared.

Results revealed an effect of previous mention in both tasks: when the theme was mentioned in the setup sentence it was more likely to be mentioned early in the production task and prompted faster lexical decision times. No additional advantage for topic status was found in either task. When considered with previous findings, these results suggest that the influence of topic status on production may be specifically limited to those cases when speakers are preparing to frame utterances for production. When they are not doing so, either because the task does not demand it of them (as in lexical decision), or because of task switching demands (the production task in this experiment), then topichood does not exert an influence. This suggests that the influence of topic status is not due to increases in accessibility for topic referents, but something specific to the sentence production system.

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Effects of prosody and transitivity biases in auditory syntactic ambiguity resolution

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Reading sentences with early closure (EC) ambiguities produce garden path effects that are influenced by factors such as verb transitivity biases and plausibility (e.g., Van Gompel & Pickering, 2001). These lexical effects do not occur when the syntactic structure is disambiguated by punctuation or additional clauses. The effect of these lexical factors in the auditory modality has been studied using cross-modal naming (e.g., Kjelgaard & Speer, 1999). These studies have shown that the auditory counterpart to punctuation, prosody, also affects on-line processing. However, the cross-modal technique only measures processing at one point in each sentence. The present study used self-paced listening to investigate whether prosody interacts with lexical information to produce garden path effects similar to those observed in self-paced reading studies.

Twenty participants listened to 15 pairs of sentences with EC syntax that were pronounced with cooperating and neutral prosodies as described by Kjelgaard and Speer (1999; Table 1). Cooperating prosodic contours mark the phrase boundary after V1 while neutral prosodic contours do not clearly mark phrase boundaries (e.g., Kjelgaard & Speer, 1999). One member of each pair had a transitively biased V1 with a plausible DO, and the other had an intransitively biased V1 with an implausible DO. The stimuli were combined with 312 fillers (60 had late closure syntax) and divided into 4 lists. All participants heard all lists in separate testing sessions. During the self-paced listening task, participants paced through each segment of each sentence by pressing a button on a button box interfaced with the computer. All stimuli were followed by True/False comprehension probes (Table 1). Response accuracy and reaction times for each button press were collected.

LTs for the critical segments (NP2 and the main verb) were analyzed in separate 2-way ANOVAS (transitivity × prosody). There were significant interactions of transitivity and prosody for both NP2 and the main verb (V2). LT's were longer for NP2 in the neutral prosodic condition when the subordinate verb (V1) was intransitive. In contrast, LT's for NP2 in the cooperating prosodic condition were longer when V1 was transitive. LT's were longer for V2 in the neutral prosodic condition when V1 was transitively biased, suggesting that NP2 was initially interpreted as the DO, with resolution of the ambiguity delayed until V2. There were no significant differences in the cooperating prosodic condition.

The results suggest that prosody interacts with transitivity during resolution of EC ambiguities, and that prosodic cues function similarly to commas in disambiguation of this structure. Cooperating prosodies cued participants to pursue an EC interpretation. When this conflicted with a plausible DO, processing load increased immediately and transiently. When the prosodic structure was ambiguous, lexical effects were found at NP2 following intransitively biased subordinate verbs and at V2 following transitively biased subordinate verbs. These results suggest that self-paced listening is sensitive to effects of conflicting prosodic and lexical cues during syntactic ambiguity resolution.

Table 1. Examples (slashes depict segmentation for self-paced listening)

Transitive bias:	While the parents / watched (V1) / the child (NP2) / sang (V2) / a song / in the kitchen.
Intransitive bias:	While the parents / danced / the child / sang / a song / in the kitchen.
Comprehension probe:	The parents danced together.

Table 2. Listening Times (msec, [*]p<.05)

	Cooperating Prosody		Neutral Prosody	
	NP2[*]	V2	NP2[*]	V2[*]
Transitively biased verb:	421	397	399	463
Intransitively biased verb:	388	398	429	382

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Modifiability and restrictiveness

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A number of widely-studied syntactic ambiguities involve noun phrase modification (e.g. VP/NP attachments like "John saw the spy with the binoculars" and RC attachments to two NPs like "Someone shot the servant of the actress who was on the balcony"). Thornton, MacDonald, and Gil (JEP:LMC, 1999) examined the role of the modifiability of NPs on the preference to interpret ambiguities like this. In a number of sentence continuation experiments, they found that NPs that were specific were less likely to take additional modification than NPs which were non-specific: NPs like "my front hall" (1a) were modified in 13% of the continuations, whereas NPs like "the only hall" (1b) were modified in 27% of the continuations.

However, in many of Thornton et al.'s items the non-specific NP contained a prenominal modification that explicitly set up a contrast set (such as "only"). So it is difficult to know whether people produced fewer modifications to specific NPs ("my front hall") or whether they produced more modifications to NPs that elicit contrast sets ("the only hall"). More importantly, it was not clear from these experiments whether the modifiability effect is driven by how much information is given about an NP (the more information you have about an NP the less likely you are going to provide even more information) or by how likely it is that the specific NP was successfully singled out as a discourse entity (if you already know which "hall" is being referred to it is unnecessary to restrict even further).

We investigated these issues in a similar sentence continuation task. First, we used non-specific NPs that consisted simply of the determiner "the" and a noun ("the office" in 2a and 2c) and specific NPs that consisted of the same noun but including a genitive ("Bob's office" in 2b and 2d). Second, instead of using PP modification, we used relative clause modification. This allowed us to investigate our second research question by manipulating the restrictiveness of the relative clauses: the relative clause was either restrictive using the relative pronoun "that" and no comma (see 2a and 2b) or it was nonrestrictive using a comma and the relative pronoun "which" (see 2c and 2d). The data showed a significant interaction in number of NP2 modifications ($p < .05$) in that specific NPs were modified less than non-specific NPs, but only in the restrictive cases (9% versus 24%, $p < .01$) and not in the nonrestrictive cases (14% versus 15%, $F<1$).

These data show that the modifiability effect is real and is not due to elicitation of contrast sets in the non-specific NPs that Thornton et al. used. More interestingly, our data also show that the modifiability effect is probably driven by the fact that a specific NP is more likely to successfully have singled out a discourse referent and not simply by the amount of information that is given about an NP. We will discuss the implications for current accounts of syntactic ambiguity resolution.

Examples

(1a) The computer down my front hall with… (13% NP2 modifications, Thornton et al.)

(1b) The computer down the only hall with… (27% NP2 modifications, Thornton et al.)

(2a) The programmer used the computer in the office that… (24% NP2 modifications)

(2b) The programmer used the computer in Bob's office that… (9% NP2 modifications)

(2c) The programmer used the computer in the office, which… (14% NP2 modifications)

(2d) The programmer used the computer in Bob's office, which… (15% NP2 modifications)

Disentangling incremental and top-down parsing: Experimental evidence from VO/OV word order patterns in code-switching

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Many studies show that the parser makes predictions for upcoming structure in a left-to-right fashion, i.e., 'look-ahead', e.g., Bakker (2005). However, it remains controversial whether syntactic structure is projected: (1) incrementally, e.g., Phillips (2003); (2) in a strict top-down fashion; or (3) top-down, but on the basis of information encoded in specific syntactic nodes only. Most findings appear to be compatible with each of these accounts. In the present study, it is argued that bilingual code-switching data, specifically switched clauses in which the phonological content comes from one language while the syntactic structure comes from the other, can prove a useful tool for individually testing these alternative approaches.

Method & Design

In an online Sentence Matching experiment, where participants have to judge whether two sequentially appearing strings of words are identical or not, e.g., Freedman & Forster (1985), bilinguals of English (a VO language) and Dutch (predominantly OV) were tested on several types of code-switched Subj-Aux-VO/OV sentences. The conditions varied with respect to: (1) word order (VO; OV); (2) switching point (no switch, tested on monolinguals; switch after Subj / after Aux / after O); and (3) switching direction (Dutch > English; English > Dutch). For example, reaction times (RTs) to sentence pairs like (1a) were compared to RTs to sentence pairs like (1b), and pairs like (2a) to (2b). Only correct responses and only RTs to identical pairs were included for analysis.

Results

No differences were observed between monolinguals' behavior on sentences without a switch and bilinguals' behavior on strings in which the subject was expressed in one language while the rest of the sentence was realized in the other: Dutch Aux-OV yielded significantly faster RTs than Dutch Aux-VO, and English Aux-VO was highly preferred over English Aux-OV. Thus, the nature of the subject does not seem to affect the preferred word order in the switched clause.

Results for sets of sentence pairs like (1) indicated that participants preferred the word order congruent with the language of the auxiliary, i.e., (1a) pairs yielded significantly faster RTs than (1b) pairs. A tendency in the same direction was obtained for the (2) pairs: participants preferred (2a) pairs over (2b) pairs.

RTs to switches after the object paired with the results of the (1) and (2) comparisons: Varying the language of the object had no influence on OV vs. VO preference.

Conclusions

In conclusion, the present study shows that code-switching data can provide insight into parsing mechanisms: The results suggest that (empty) syntactic templates are projected 'ahead', in a top-down fashion; these projections, however, are triggered by information associated with the (phonological) content of specific syntactic nodes only (here, the inflected verb as opposed to the subject, the object, or the main verb). These findings are incompatible with a 'static' top-down approach as well as a node-by-node incremental account of sentence comprehension.

Examples

(1) English > Dutch
  a. The newspaper will MELDEN HET SLECHTE BERICHT. (x2)
  b. The newspaper will HET SLECHTE BERICHT MELDEN. (x2)

(2) Dutch > English
  a. DE OCHTENDKRANT ZAL the bad news report. (x2)
  b. DE OCHTENDKRANT ZAL report the bad news. (x2)

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"Which" is costly. Discourse-linking versus phrasal complexity during wh-question processing

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The research presented here deals with differences between "who" and "which" observed during wh-question processing.

First of all, experimental data from self-paced reading studies carried out in Dutch clearly show that the processing of a "which" question is more costly than the processing of an equivalent with "who". This difference, however, is confined to object-gaps. This outcome does not stand alone: similar (cross-linguistic) results have been obtained from other behavioral studies (Shapiro, 2000) as well as aphasiology (Avrutin, 2000) and research using ERPs (Kaan et al 2000). These results led to the following issue: are (object) "which" questions more costly simply because of their more complex phrasal structure, or because they require reference to a specific set in the discourse determined by the head noun of the "which" phrase ("politicians" in "which politician") on top of everything else? Experimental sentences like those given below (1) resulted in conclusive evidence for the latter option: discourse-linking -or: set-restriction- rather than phrasal complexity adds to the total processing cost of an object wh-question; a "which person" phrase implying the same unrestricted set as "who" patterned with "who" rather than with the more restricted "which politician" type of question.

(1) Context: Terwijl de dronken bediende een dutje deed, zocht de keizer de nuchtere bediende in de kelder.

While the drunken servant was taking a nap, the emperor looked for the sober servant in the cellar.

Wh-question   [Wie] / [welke bediende] / [welke persoon] heeft de keizer gezocht in de kelder?

SO   [*Who*] / [*which servant*] / [*which person*] $_{-SUB}$ *has the emperor-$_{OBJ}$ looked-for in the cellar?*

OS   [*Who*] / [*which servant*] / [*which person*] $_{-OBJ}$ *has the emperor-$_{SUB}$ looked-for in the cellar?*

This outcome, in turn, raised the question whether "which" questions benefit from an existing set, pre-determined in the (discourse) context. Again, a combination of Dutch self-paced reading studies (cf. sample materials 2) showed that only object "which" questions with a specified head noun (i.e. "which politician" versus the generic "which person") benefit from pre-established sets in the preceding context.

(2) Context: Tijdens de wekelijkse vergadering werd er een voorstel gedaan door de burgemeester. Hoewel het voorstel de progressieve politicus aansprak, heeft de conservatieve politicus het afgewezen.

During the weekly meeting a proposal was made by the mayor. Although the proposal appealed to the progressive politician, the conservative politician rejected it.

Wh-questions (with and without preceding context)

               [Wie] / [welke politicus] / [welke persoon] heeft het voorstel [*participle*] tijdens de vergadering?

SO   [*Who*] / [*which politician*] / [*which person*]$_{-SUB}$ *has the proposal-$_{OBJ}$ [rejected] during the meeting?*

OS   [*Who*] / [*which politician*] / [*which person*]$_{-OBJ}$ *has the proposal-$_{SUB}$ [appealed-to] during the meeting?*

From the above it can be concluded that the delay for "which" questions compared to "who" during processing originates in the necessity to link to a particular set (to be) determined in the discourse, and much more strongly so when the set has to be constructed on the fly. The fact that the pattern is restricted to object-gaps assumes a processing-load approach.

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The effects of visual and prosodic information on spoken language comprehension

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The interaction of information sources continues to be a central question in the field of language comprehension. We investigated the effects of visual and prosodic information on the processing of garden-path sentences like (1). Reading studies have shown that participants are likely to misinterpret these sentences because they incorrectly attach *the dog* as the object of the verb *cleaned*. However, other studies have shown that prosody in spoken sentences can help resolve syntactic ambiguity. The purpose of the first experiment was to determine if an appropriately placed prosodic break would influence the interpretation of subordinate-main sentences.

Experiment 1 manipulated a single variable with two levels. Prosody was either cooperative or neutral with respect to the correct syntactic structure. Cooperative prosody consisted of an intermediate prosodic break between subordinate and main clauses. Sentences with Neutral prosody were spoken as a single uninterrupted intonational phrase. Participants listened to sentences and answered questions like (2). Neutral prosody produced fewer correct responses than cooperative prosody (52% vs. 86%). This shows that prosody is a powerful cue to the intended meaning of these sentences.

Experiment 2 manipulated two variables. Visual context was either consistent or inconsistent with the meaning of the subordinate clause. Consistent visual context depicted a woman is cleaning something that is not a dog, and inconsistent visual context depicted a woman cleaning a dog. Prosody was either cooperative or neutral. Participants were told that they would be presented with a spoken sentence and a picture, and that the picture might or might not be related to the sentence. Their task was to answer the question on the basis of the information in the utterance. If initial parsing is equally sensitive to both visual and prosodic information, as predicted by some interactive processing models, then these two constraints should produce equal effects on comprehension. Alternatively, if initial parsing is based only on bottom-up information, then we expect the effect of prosody to be greater than visual context. Dependent variables were comprehension accuracy and pupil diameter.

Question-answering performance showed that cooperative prosody produced more correct responses than neutral prosody, and consistent visual context produced more correct responses than inconsistent visual context. This suggests that both constraints affected offline comprehension. Pupil diameter has been used as measure of processing effort or intensity during sentence comprehension. Just and Carpenter (1993) investigated the processing of object and subject relative sentences, and they found that pupil diameter reliably increased following the point in an ambiguous sentence where processing demands increased. We analyzed pupil diameter in a 1200 ms time window beginning at the onset of the disambiguating word *stood*. A bivariate regression using time as a predictor variable and pupil diameter as a dependent variable was used to determine the pupil diameter slope. The results showed greater pupil dilation with neutral prosody compared to cooperative prosody, and greater pupil dilation with inconsistent than with consistent visual context. Pupillometric measures therefore, suggest that visual and prosodic information work cooperatively during online comprehension.

Examples

While the woman cleaned the dog that was big and brown stood in the yard.

Did the woman clean the dog?

The effect of phonological realization of inflectional morphology on verbal agreement in French: Evidence from ERPs

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Studies of both non-native and native readers have suggested that the presence of phonological cues leads to faster learning of morphological rules and more stable representations of these rules. For example, Arteaga, Herschensohn & Gess (2003) have suggested that a thorough grounding in L2 phonological patterns is essential for language learners; and present evidence of the importance of phonological information for the acquisition of morphological form in French. Behavioral studies involving native speakers of both French (Largy & Fayol, 2001; Negro & Chanquoy, 2000) and Dutch (**Sandra,** Frisson, & Daems, 1999) have shown, as well, that fewer inflectional errors in written language (for both verbal and nominal number) are observed for phonologically realized morphemes than for silent morphemes, both during development (Negro & Chanquoy, 2000) and in skilled adults (Largy & Fayol, 2001; Sandra et al, 1999). The present study examined the impact of the phonological realization of morpho-syntactic agreement within the inflectional phrase (IP) in written French, as revealed by the ERPs. On the one hand we varied the presence vs. absence of phonological cues to morphological variations (cf. examples 1a-1c). On the other, we examined the effect of the regularity of the phonological form of morphological endings (cf. examples 2a vs. 2b, and 3a vs. 3b); in French, the persons "nous" and "vous" are systematically paired with the same phonological form (even for many irregular verbs), whereas the other verbal persons vary in phonological form across verb classes (both regular and irregular). Of interest was whether a graded ERP response to these different conditions could be found in native speakers, on the one hand (current study), and whether non-native learners would benefit from the presence and regularity of phonological cues during second language acquisition, as shown by differences in the rate of acquirement (study in progress). The results for native French participants indeed showed a graded response as a function of the type of inflectional error. Compared to grammatically correct instances 1a), silent inflectional errors produced a significant P600 response (1b), which was statistically smaller than that produced by errors that were phonologically realized (1c). Moreover, compared to grammatically correct instances (2a and 3a), errors for "vous" and "nous" (2b) produced a P600 response which was significantly larger than that found for other verbal person errors (3b), despite the error being equally phonologically marked in the materials. Forthcoming data should provide evidence whether non-native adult learners show similar benefits of the phonological realization of morphemes and the systematic covariation between morphology and phonology.

Examples

1a. Le matin je mange très peu.

1b. Le matin je *manges très peu. (incorrect, phonologically silent)

1c. Le matin je *mangez très peu. (incorrect, phonologically realized)

2a. Le mardi nous mangeons au restaurant universitaire.

2b. Le mardi nous *mangent au restaurant universitaire. (incorrect, phonologically realized)

3a. Le mardi ils mangent au restaurant universitaire.

3b. Le mardi ils *mangeons au restaurant universitaire. (incorrect, phonologically realized)

Default interpretation of negation and the question of suppression

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Questions. 1. Is there a specific default interpretation assigned to the negative marker? 2. Is negation sensitive to discoursal considerations?

Background. The negative marker (English *no*, Hebrew *lo*) has a semantic broad scope, which, in context, is narrowed down to a specific "understanding" (Horn 1989) or "sense" (Atlas 1989). Researches assume two approaches to the question of its effect. Psycholinguists assume that the negative marker functions as a cue for the addressee to automatically suppress the negated information (MacDonald & Just 1989, Hasson & Glucksberg in press). Others posit that suppression following negation is not automatic but context sensitive. Consequently, the processing of negative sentences does not differ from that of affirmatives (Giora in press). The latter approach can be motivated by Gernsbacher's (1990) Structure Building Framework: the information presented first is used as the pivot point, and the following information is mapped upon the structure built. Suppression is a device for building the discourse structure, and is used when topic shift occurs.

Materials. Materials included Hebrew minimal pairs involving negation – (a) NP Neg VP; (b) Neg NP VP (see appendix). These were followed by a sentence, which was coherent with the previous sentence only if the negation in that previous sentence would be interpreted as negating the subject and maintaining the action. While the negation in the marked (b) sentences can be interpreted only as negating the NP, and would already be in line with the new information of the second sentence, interpretation of the (a) sentences is predicted to be different. If there is a default interpretation attributable to the negative marker in that unmarked position, it would be assigned, as the sentence appears discourse-initially. Upon encountering the new information, however, the reader needs to re-analyze her interpretation, and switch from an NP-preserving VP-negating interpretation to an NP-negating VP-preserving one. This difference in the processing routes should be reflected in the reading times. Each minimal pair had a third non-coherent counterpart as a control. 24 triplets were used in three conditions. Each condition consisted of one variant of each triplet, balanced such that all subjects were exposed to all 3 sentence types. 24 fillers involving different types of negation were used. 2/3 of the items and fillers were followed by comprehension questions.

Procedure. 39 students were recruited for a self-paced reading task.

Results and Discussion. Results from a between-subject ANOVA reveal that NP-Neg targets and the first word of these targets were read faster than those of the Neg-NP ($p<.05$ for both). In all locations measured, the controls were read more slowly ($p<.005$).

These results suggest that no default reading is assigned to negation, thus supporting the view that it does not automatically suppress the information within its scope. However, when no previous context is available, the sentential subject is not preserved (*pace* Gernsbacher 1990). Thus, it is suggested that a general scope interpretation is retained until further information is given (c.f. Carston 2002). This processing strategy has been shown to apply in other cases of multiple senses (Pickering & Frisson 2001).

Examples of Materials

NP NEG VP. Target sentence.

ha-marce lo patax et ha-delet. ha-ru'ax patxa ota.
the-lecturer NEG opened the-door. the-wind opened it.
'The lecturer didn't open the door. The wind opened it'.

NEG NP VP. Target sentence.

lo ha-marce patax et ha-delet. ha-ru'ax patxa ota.
NEG the-lecturer opened the-door. the-wind opened it.
'It was not the lecturer that opened the door. The wind opened it'.

Unrelated NP NEG/NEG NP VP. Target sentence.

ha-adam hu ce'eca shel ha-kof. ha-ru'ax patxa ota.
the-man is descendent of the-monkey. the-wind opened it.
'The man evolved from the monkey. The wind opened it'.

Processing extraposed structures in English: grammatical and processing factors

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This paper presents two self-paced-reading experiments investigating the relative costs of a grammatical constraint – *phrasal-adjacency* – and a working-memory constraint – *locality* (preference for local attachments). To do this, we examined extraposed structures in English. Unlike most English constructions, extraposed structures cannot be generated by a head-dependent context-free grammar whose rules have the form X→Yi…Yn, where (a) Yi…Yn are adjacent (*phrasal-adjacency*), (b) one of the right-hand-side categories Yi is the head-category of X, and (c) remaining right-hand-side categories are semantically dependent on Yi. Extraposed structures violate the phrasal-adjacency constraint: in (1a), the relative clause (RC) "who was hired for the wedding" depends on the head-noun "musician", but is not phrasally-adjacent to it.

Experiment 1 compared extraposed structures (1a) to non-extraposed structures (1b). Over the critical-region (the verb and the RC), the phrasal-adjacency constraint predicts the extraposed structures to be more difficult. In contrast, the locality constraint predicts the non-extraposed structures to be more difficult, because the RC intervenes between the subject and the verb resulting in a non-local attachment. (Note that there is a non-local attachment in the extraposed structures, too – between the subject and the relative pronoun "who" – but regardless of how distance is measured (e.g., words (Hawkins,1994), discourse-referents (Gibson,1998;Warren & Gibson,2002), similar intervening elements (Gordon et al.,2001;VanDyke & Lewis,2003;McElree et al.,2003)), the attachments in the non-extraposed structures are at least as long/longer than those in the extraposed structures.)

The results demonstrated that the extraposed structures were processed more slowly, suggesting that the phrasal-adjacency constraint dominated the locality constraint in these constructions.

Experiment 2 manipulated the length of the RC in order to test whether the locality constraint may dominate the phrasal-adjacency constraint for longer-distance attachments ((2a)-(2b)). The length-manipulation had four levels of difficulty in terms of the number of discourse-referents and in terms of syntactic structures involved: (1) short RC ("who was hired yesterday"), (2) medium RC ("who was hired yesterday for the wedding"), (3) long RC with an additional prepositional phrase ("who was hired yesterday for the wedding at the famous French castle"), and (4) long RC with an additional clause ("who was hired yesterday for the wedding where many celebrities were invited"). The results demonstrated a cross-over interaction between RC-length and extraposition, such that when the RC was short, medium or long with an additional prepositional phrase, the phrasal-adjacency constraint dominated, making the extraposed structures more difficult (replicating Expt 1), but when the RC was long and involved an additional clause, the locality constraint dominated, making the non-extraposed structures more difficult. Note that the nature of syntactic structures involved in the length-manipulation was important (a long RC with a prepositional phrase vs. a long RC with a clause). These results are important for the existing distance-metrics in long-distance dependencies.

The results of the two experiments provide support for a view of the grammar and processing as a set of soft weighted constraints. Implications for existing alternative views of the grammar, and for working-memory-based theories of sentence processing will be discussed.

Examples

1a. **Extraposed RC**: After the dinner, a musician **arrived** who was hired for the wedding, and the guests…

1b. **Non-Extraposed RC**: After the dinner, a musician who was hired for the wedding **arrived**, and the guests…

2a**. Extraposed RC**: After the dinner, a musician **arrived** who was hired yesterday (for the wedding) (at the famous French castle / where many celebrities were invited), and the guests…

2b. **Non-Extraposed RC**: After the dinner, a musician who was hired yesterday (for the wedding) (at the famous French castle / where many celebrities were invited) **arrived**, and the guests…

Reconstruction: a plea for Dynamic Syntax

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The aim of our study is to show that Reconstruction, known as the interaction between displacement and interpretation, is best analysed within Dynamic Syntax (see *Cann et al. (2005)*), which directly reflects dynamics of incremental parsing. We will provide novel reconstruction data that cannot be handled under traditional approach proposed in the generative framework (see *Chomsky (1995)* or *Aoun et al. (2001)*), whereas the notion of underspecification in Dynamic Syntax provides a straightforward account for these data.

1 Unexpected reconstruction

In generative grammar, reconstruction is traditionally linked to the copy theory of movement. In 0, interpretation of the bottom copy leads to the reconstructed functional reading in which every man likes a different picture.

However, this approach can hardly account for reconstruction with resumption if we consider arguments for the absence of movement with this strategy, i.e. its ability to cross islands (see *Aoun et al. (2001)*, though). More interestingly, it is even helpless facing novel data from French (similar data in Jordanian Arabic) such as 0, where reconstruction holds within a strong island. If movement is the only trigger for reconstruction, how can we explain that the presence of an adjunct island in 0 does not block the reading in which the pronoun is bound by the quantifier?

2 Dynamic reconstruction

Dynamic Syntax is a formalism in which parsing and grammar interact: parsed lexical items are programs by which the initial semantic representation (requirement for a sentence, written *?Ty(t)*) is updated. Central to Dynamic Syntax is the notion of underspecification. Notably, as shown by the sketch of the process in 0, any displaced element can be treated in the tree with an underspecified address (a kind of unfixed node following the pointer ◊) that will be further updated as the thematic position of the displaced element is introduced through the parse of the predicate. Within this framework, we argue that reconstruction just corresponds to a delay of evaluation licensed by this structural underspecification. The functional reading in 0 is expected, as semantic contribution of the displaced constituent (⟦picture⟧) can be evaluated when it unifies with the (empty) object position required by the verb *like*. Notice that structural unification is similar to movement, as it is syntactically constrained (by islands). This approach also accounts for unexpected cases of reconstruction with resumption within islands. In Dynamic Syntax, a resumptive pronoun behaves like any pronoun (i.e. an underspecified variable): it is then subject to another possible unification process which is not syntactically constrained, the anaphoric unification with its antecedent. The functional reading in 0 is then expected, as semantic evaluation of ⟦the picture of his students⟧, the displaced constituent, can be postponed until it anaphorically unifies with the underspecified object position of *tear*.

We will finally show how the presence of lexical underspecification in displaced constituents is also crucial to account for further paradoxes about reconstruction:

- definite versus indefinite relatives;

- condition A and variable binding versus condition C.

Examples

(1)   Mary saw the picture that every man likes ~~picture~~.

(2)   La photo$_2$ de ses$_1$ étudiants, chaque professeur$_1$ est fâché parce que tu l$_2$'a déchirée.
"The picture$_2$ of his$_1$ students, each teacher$_1$ is furious because you tore it$_2$."

(3)   Parsing *Joan, Hilary upset* (with ◊ being the pointer: it represents the node under development):
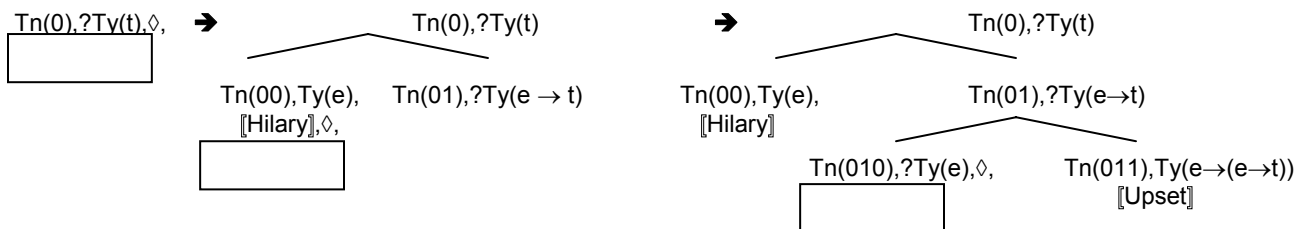
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Length effects in PP-attachment: Prosody or pragmatics?

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Fodor's (1998) Same Size Sister principle states that ambiguous modifiers such as RCs or PPs are preferentially attached to a head of similar prosodic size. For two-site ambiguities of the type [NP1-of-NP2-RC/PP] this means that a long RC is preferentially attached to NP1 since NP1 includes NP2 and is therefore longer than NP2 only. Short RCs on the other hand are preferentially attached to the shorter NP2 which is of similar prosodic heaviness. Fodor further assumes that this prosodic explanation can also be applied to silent reading since readers compute a prosodic representation of the sentence even while reading silently.

Length effects in most experiments are, however, also compatible with a pragmatic interpretation: The longer RC contains more and more detailed information, and therefore there is a higher tendency to attach it to a more central element of the proposition. We ran a series of questionnaire studies in French, comparing PPs with invented city-names which differed only in syllable length(1a-c, 2a-c). No content words were added to increase length. Participants had to indicate their preference in a paraphrase like (3). The complex NPs appeared in subject (1) or in object (2) position. In this experiment, we found a very strong preference for low attachment as it has been found in other languages before, which was not modified by length or sentence position. Increasing syllable length should have changed the attachment pattern if the length effect was purely prosodic. A possible counterargument may be that the unknown city names in this experiment were just overlooked by the participants. We ran a further experiment with real city-names differing in length as in (4a-c, 5a-c). Using real city names, however, didn't change the pattern of data. There was still no length effect.

In a third questionnaire, we constructed materials, adding content words as in (6). Here, a highly reliable 13% increase of N1-attachments was found. However, the long versions in these examples were also longer than the long versions in the earlier experiments, and this may be the reason why we found a length effect here. Unfortunately, it is not possible to lengthen the French PPs just by a single word. So we ran a fourth study in German with materials based on the French questionnaires with a short (one-syllable) city name (7a), a long version with a composed city name (7b), and a third condition, where we added an adjective(7c). Here, the two long versions did not differ in length. Whereas there was only a non-reliable 5% increase of N1-attachments for long city-names, adding an adjective led to a highly reliable 17% increase of N1-attachments.

The pattern of data found in this series of experiments is highly compatible with a pragmatic interpretation of the length effect. Still, the two long versions in the German experiment surely differ in their prosodic structure as well. So we can only conclude for sure that length alone is not the decisive factor for attachment in our experiments. We are currently recording speakers uttering sentences like (6a-b) to analyze the specific prosodic patterns which might influence attachment preferences.

Materials

(1) a-c. L'assistant de l'avocat de *Gallu / Gallurégnoto / Gallu-Régnoto* a discuté avec le nouveau juge.
  The assistant of the lawyer from Gallu / Gallurégnoto / Gallu-Régnoto discussed with the new judge.

(2) a-c. Le nouveau juge a discuté avec l'assistant de l'avocat de *Gallu / Gallurégnoto / Gallu-Régnoto*.
  The new judge discussed with the assistant of the lawyer from Gallu / Gallurégnoto / Gallu-Régnoto.

(3) Le/la/l' ………………. vient de Gallu.
  The ………………. comes from Gallu.

(4) a-c. L'assistant de l'avocat de *Apt / Albertville / Aix-en-Provence* a discuté avec le nouveau juge.

(5) a-c. Le nouveau juge a discuté avec l'assistant de l'avocat de *Apt / Albertville / Aix-en-Provence*.

(6) a-b. Le nouveau juge a discuté avec l'assistant de l'avocat de *Apt / la belle ville d'Apt*.

(7) a-c. Der neue Richter diskutierte mit dem Assistenten des Notars aus *Au / Au-Winterach / dem schoenen Au*.

Native speakers and second language learners use fine-grained prosodic distinctions in parsing early closure sentences

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The Informative Boundary Hypothesis (IBH; Clifton et al. 2002) claims that (i) the effect of a local prosodic boundary depends on its size relative to other relevant boundaries, i.e. whether it is larger, smaller or the same size as the previous boundaries; and (ii) finer-grained distinctions of how much larger or smaller a boundary is than a previous boundary do not affect parsing. For example, the IBH predicts an intonation phrase (IPh) boundary and an intermediate phrase (ip) boundary should have identical effects on syntactic parsing following a word-level (wd) boundary, because both ip and IPh boundaries are larger than word-level boundaries. This study investigated extensions of the IBH to English native speakers (L1ers) and Korean learners of English (L2ers) in the comprehension of early closure structures in spoken English sentences as in (1).

An end-of-sentence comprehension experiment and a cross-modal naming experiment measured reaction times in five conditions that varied the size of the prosodic boundaries surrounding the ambiguously attached NP (e.g., "the house" in (1)). Each experiment tested three different "cooperating" prosodic patterns in which the prosodic boundary at position #1 was larger than the one at #2 (as in (1)), and two "same-sized" prosodic patterns with boundaries of matching phonological size at position #1 and #2. The materials were controlled to avoid strong lexical biases and to vary only in the key prosodic boundaries, and were recorded and analyzed by ToBI-trained phoneticians. Based on the IBH, cooperating prosodic patterns should produce shorter RTs than same-sized patterns, and sub-types of cooperating prosody should show similar RTs to each other, as should sub-types of same-sized prosody.

The results indicated several effects. First, in each experiment, both English L1ers and Korean L2ers responded significantly more slowly to the same-sized conditions overall than to the cooperating ones, suggesting that cooperating prosodic patterns were more disambiguating than same-sized patterns. However, sub-types of the cooperating and same-sized patterns produced significantly different effects. In the cross-modal naming experiment, for both L1ers and L2ers RTs were significantly shorter for the IPh-wd and IPh-ip patterns than for the ip-wd pattern, and for the IPh-IPh pattern than the ip-ip one. In the end-of-sentence experiment, both L1ers and L2ers showed significant differences across the same-sized patterns, but only L2ers did so across the cooperating patterns. These results indicate that participants' performance cannot be fully captured by an IBH-style analysis alone, and that ips in position #1 were somewhat less effective than IPhs in disambiguating syntax. We will argue that absolute boundary size is important in critical sentential positions. Unsurprisingly, RTs in Korean L2ers were significantly longer than those of English L1ers, in each experiment. There were also significant interactions of prosodic boundary patterns and language groups, with the L2ers exhibiting particularly long RTs for the ip-wd and ip-ip patterns.

Overall, these experiments show that in both L1 and L2 processing, relative boundary size has significant effects. Yet, the 3-way prosodic boundary categorization of cooperating, same-sized, and conflicting is insufficient for at least some types of syntactic structures.

(1) Examples: Prosodic boundary patterns for early closure stimuli

Experiment 1: End-of-sentence comprehension experiment

1a.   When Roger leaves *(#1)* the house *(#2)* is dark.

IPh	wd	Cooperating
IPh	ip	Cooperating
ip	wd	Cooperating
IPh	IPh	Same-size
ip	ip	Same-size

Experiment 2: Cross-modal naming experiment

Auditory stimulus	*Visual stimulus*
1b. When Roger leaves (#1) the house (#2)	is

Intonational effects in the comprehension of discourse contrast

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Speakers often signal the contrastive status of discourse information using intonation, e.g. "I want the BLUEBERRY muffin, not the CRANBERRY! Previous spontaneous speech production experiments demonstrated that speakers used a (L+H*) pitch accent more frequently than others (H* or L*) to mark the contrastive aspect of a discourse entity. To investigate the role of accents during discourse comprehension, eye-movements were monitored in three experiments. Participants followed pre-recorded instructions to decorate holiday trees. Participants faced a grid with ornaments, and decorated the tree following instructions such as "Next, hang the blue ball". Grids contained twelve cells, with eight sets of targets (e.g., balls, angels, candies, drums) and four sets of distracters painted in eleven colors (e.g., blue, green, red), and sorted by object type on the grid. A head-mounted eye-tracker (ASL e5000) recorded eye position on the grid. Experiment 1 compared felicitous and infelicitous use of L+H*. When L+H* felicitously marked contrast on the color adjective ("First hang the red ball. → Next, hang the BLUE ball": L+H* on BLUE), fixation proportions to target cells increased more quickly than when L+H* infelicitously marked the immediately repeated noun ("Hang the red ball. → Next, hang the blue BALL."). In contrast, felicitous L+H* on the noun ("Hang the blue ball. → Then, hang the blue DRUM.") did not speed eye-movements to the target as compared to L+H* on the immediately repeated color adjective ("First, hang the blue ball. → Then, hang the BLUE drum."). These results suggest that listeners 'tuned' to tonal cues that were relevant to the task (i.e., color adjectives were more useful than object names in searching a grid organized by object). Experiment 2 demonstrated that L+H* on an adjective led to 'anticipatory' fixations. Participants fixated incorrect cells when they heard infelicitous L+H* on a color. For example, in "red onion → GREEN drum," initial fixations were to the 'onion' cell. These initial fixations were observed immediately after the adjective offset, within the time window before the object noun could have been fully processed. In Experiment 3, L+H* was placed on discourse markers (DMs) (e.g., "And THEN"), to test whether contrastive intonation on a DM led to similar anticipatory eye-movements. Immediate fixations were not observed after a DM with L+H*. Instead, listeners were sensitive to intonational incompatibility between the DM and adjective. Fixations were sustained longer, suggesting processing difficulty when a contrastive DM was not followed by a contrastive color adjective ('green ball' → "And THEN, hang the blue ball") than when it was followed by an adjective with L+H* ("And THEN, hang the BLUE ball."). Similarly, fixations increased over time when only the adjective, but not the DM, had L+H* ("And then, hang the GREEN drum"), whereas fixations declined earlier when neither the DM nor the adjective had L+H* ("And then, hang the green drum"). The presence of anticipatory fixations demonstrates the predictive use of intonation in discourse interpretation. Effects of DM and adjective accent combinations demonstrate the importance of maintaining coherence in the function of consecutive accents within a discourse.

The role of L1 syntactic knowledge during L2 sentence processing: Evidence for a facilitatory effect

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Previous studies (e.g., Frenck-Mestre & Pynte, 1997; Felser, Roberts, Marinis, & Gross, 2003) suggested that syntactic information from the native language (L1) can produce difficulties during second language (L2) processing. In contrast, the current study investigated potential facilitatory effects: In sentences where L1 and L2 syntax result in different analyses, syntactic information from L1 may sometimes actually be helpful to resolve syntactic ambiguities in L2 sentences.

We investigated how native speakers of English and German process temporarily ambiguous English structures such as (1a). Native speakers of German were chosen because in a German word-by-word translation of (1a), only the intransitive analysis is possible at "writing": The transitive analysis is ruled out at the subordinate verb ("writing"), because in German subordinate clauses the direct object must precede the verb (e.g., "Während der Schauspieler die Biographie schrieb …"). If Germans make use of L1 knowledge, this should actually help them to avoid a garden-path.

Participants read temporarily ambiguous English primes such as (1a), control primes disambiguated by a comma such as (1b), and baseline primes without any syntactic structure such as (1c). Total sentence reading times were measured.

(1a) "While the actor was writing the biography which was shocking and controversial fell down."

(1b) "While the actor was writing, the biography which was shocking and controversial fell down."

(1c) "ugly magnificent illusory calm dangerous"

(2) "When the author was writi…"

Each prime was followed by a target fragment such as (2), which had to be completed by the participants. The proportion of transitive completions for the target fragments was determined: If participants initially adopt the transitive analysis ("the biography" = object) in (1a) and if this analysis remains activated (as shown by Van Gompel, Pickering, Pearson, & Jacob, 2005), participants should produce more transitive completions in the ambiguous condition than in the unambiguous condition, where the transitive analysis was never activated.

For native speakers, a significant difference in total sentence reading times between ambiguous (1a) and unambiguous control (1b) sentences was found, suggesting that they initially misanalysed (1a). The proportion of transitive completions was significantly larger after ambiguous primes than after unambiguous ones. This implies that an incorrect transitive analysis remained activated after (1a), and caused a priming effect in the target fragments.

The reading times for Germans, however, showed no difference between ambiguous and unambiguous structures. We argue that Germans find it easier to avoid the garden-path because the German equivalent of (1a) is unambiguous.

The priming data showed that the difference between the unambiguous and baseline conditions was larger for Germans than for native speakers, presumably because syntactic representations of L2 learners are less stable. In contrast, Germans produced (non-significantly) more intransitive completions after (1a) relative to the baseline condition (1c), while native speakers produced fewer. Hence, the priming data is also consistent with the idea that Germans find it easier to avoid being garden-pathed.

Our study provides evidence that syntactic L1-knowledge can have facilitatory effects during L2 processing in sentences where L1 syntax results in a different syntactic analysis than L2 syntax.

Anti-locality effects without sentence-final verbs: Even in English longer distance can cause faster processing

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According to locality-based theories of sentence processing [1, 2], increasing the distance between a head and its dependents leads to increased processing complexity. Evidence for such locality effects exists in a variety of languages (e.g. English, Chinese, and Russian). However, the opposite pattern of results, so called anti-locality effects, has also been observed, so far in head-final languages (e.g. Hindi and German; [3, 5]). These effects present a problem for locality-based theories. We present evidence from three self-paced moving-window reading experiments demonstrating that anti-locality effects can also be observed in a non-head-final language, English.

In all three experiments a relative clause (RC) intervened between the matrix-subject and the verb. We manipulated the length of the RC and measured reading times on the critical matrix-verb region. Locality-based theories predict an increase in processing time with increased distance between matrix subject and matrix verb.

In **Experiment 1** (N1=40, N2=36), we manipulated the length of the intervening RC by attaching 1-3 three-word prepositional phrases (PPs) to the embedded verb. Reading times on the matrix verb (*bought* in (1) below) decrease the more PPs are attached to the embedded verb ($F_1(2,78)=9.0$, $F_2(2,70)=9.5$, ps<.001). This anti-locality effect is problematic for locality-based theories.

However, Experiment 1 contained a positional confound. The more PPs were attached to the embedded verb, the further away was the matrix verb from the sentence beginning. In reading experiments, subjects often speed up towards the end of the sentence, and therefore results from Experiment 1 could in part be due to this positional confound. We conducted **Experiment 2** (N1=48, N2=30) to address this problem. In the new stimuli, the PPs were either attached to the RC verb or topicalized to the front of the matrix clause (see below). We found the same effect as in Experiment 1: reading times on the matrix verb decrease the more PPs intervene between the verb and its subject ($F_1(2,94)=6.8$, $F_2(2,58)=5.6$, ps<.005). These anti-locality effects are consistent with both surprisal-based [4] and anticipation-based theories [3]. Surprisal-based theories attribute the speed-up to the fact that the probability of the next word being the matrix verb increases with each RC-final PP. Anticipation-based theories attribute the speed-up to the fact that speakers have more time to prepare for the processing of the upcoming matrix verb if there are more intervening PPs. According to a third, non-probabilistic, account of anti-locality effects, the repeated re-activation of the matrix subject (due to attaching PPs in the RC) speeds up matrix verb processing (presumably, because integration of the subject into the verb is faster after repeated reactivation [5]). **Experiment 3** was aimed at distinguishing among the different accounts of anti-locality effects. The results show that repeated activation may be part of the story but cannot be all: after controlling for repeated activation, additional speed-ups are still observed for the matrix verb.

The results of all three studies are consistent with probabilistic/expectation-based sentence processing accounts [3, 4], but unexpected given locality-based account [1, 2]. Further research is necessary to determine how locality-based and probabilistic mechanisms of sentence processing interact.

EXPERIMENT 1, sample item (critical region in bold):

(1) The player that the coach met *at 8 o'clock (near the gym at 8 o'clock / near the gym by the river at 8 o'clock)* **bought the house** (by the river / by the river at 8 o'clock) […].

EXPERIMENT 2, sample item (critical region in bold)

(2) (In early November / In early November before the elections) the mayor that the advisor called (*in early November / in early November before the elections*) after the poll results **updated the report**, […].

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Investigating effects of topic and focus in the presence and absence of pronouns

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Many factors have been claimed to influence referent salience, i.e., how prominently an entity is represented in the discourse-model. Some claim that topics are most salient (e.g.[3]), and often connect this to discourse-oldness/givenness. Many regard subjects as default-topics, as subjects are often discourse-old. However, others claim that focused, new entities are more salient (e.g.[4]). Taking important steps to reconcile these views, [1] concludes that topics and foci are more salient than other referents. However, since [1]'s experiments focus on subject-topics and object-foci, it is unclear whether grammatical role--which has been argued to crucially influence salience (e.g.[2])--modulates effects of topicality/focusing.

We conducted two experiments investigating (i) the effects of grammatical role on topics and foci, and (ii) whether factors such as topicality/focusing and grammatical role influence the discourse-prominence of entities in a top-down manner (even before an anaphoric expression is encountered) or whether their influence is better regarded as a bottom-up effect resulting from heuristic search processes caused by the presence of a pronoun (see [5]).

We manipulated the grammatical role (subject/object) of topical and focused constituents as well as the sentence's syntactic structure (SVO/cleft). Clefts (ex.1c,d) encode focusing syntactically, and by comparing clefts to SVO we can investigate clefted/unclefted foci (1a/1c,1b/1d). In both experiments, participants (n=24, different people in Exp.1 and Exp.2) read the same mini-dialogs (ex.1), and were asked to say the B-part and their continuation aloud. In Exp.1, participants continued with pronoun-prompts. In Exp.2, no pronoun-prompts were provided; participants could structure their continuations freely. Targets contained all-male/all-female referents. Verbs were agent-patient verbs ([5]). Following [5], we assume that if Exp.1 shows an effect of a particular factor but Exp.2 does not, the effect is most likely related to search strategies triggered by the pronoun-prompt. If both experiments show the effect of a particular factor, this factor presumably has a top-down effect that makes referents generally prominent in the discourse-model.

Exp.1--Continuations reveal a clear preference to interpret prompt-pronouns as referring to the subject of the critical sentence (approx.60-75%). However, there is no main effect of topic/focus or pronominalization. This suggests that the 'topicality effect' in previous work (investigating subject-topics/object-foci) may be a subjecthood effect.

Exp.2--Continuations beginning with pronouns (i.e.,resembling Exp.1), show a slight preference for the subject of the critical sentence over other referents. However, this preference disappears in continuations beginning with full nouns. This suggests the subjecthood effect in Exp.1 is related to the presence of a pronoun, and does not correlate with overall likelihood of subsequent mention. A detailed analysis of Exp.2 indicates that the prominence of a referent in the discourse-model (assuming this is reflected by likelihood of subsequent mention) is influenced by multiple factors, in some configurations entirely independent from likelihood of pronominalization and the SVO/cleft distinction.

In sum, these results show grammatical role must be taken into account when analyzing effects of topic/focus on reference tracking. Moreover, the data indicate that likelihood of pronominalization and likelihood of upcoming mention can be distinct, which has implications for our view of salience/prominence.

Examples

(1) A: The maid scolded the bride.

(a) B: No, that's wrong! She(topic) scolded the secretary(focus). She….

(b) B: No, that's wrong!The secretary(focus) scolded her(topic). She…

(c) B: No, that's wrong! It was the secretary(focus) that she(topic) scolded. She…

(d) B: No, that's wrong! It was the secretary(focus) who scolded her(topic). She…

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Prosody rescues sandwiched dative in Korean

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This study argues that the nature of incrementality in processing Korean can be captured by considering pro-active use of prosody as well as other morpho-syntactic factors. In sentences as in (1), dative NP, which is sandwiched between two nominative NPs, is ambiguous. It can be interpreted either in the upcoming relative clause as in (1a) or in the non-local matrix clause as in (1b). Based on an eye-tracking study, Koh (1997) argued that Korean parsers prefer to resolve a sandwiched NP as in (1b) rather than as in (1a). Kamide and Mitchell (1999) reported similar results in Japanese based on a self-paced reading. This prediction is borne out in Minimal Revision strategy (Frazier and Clifton 1998). However, the puzzling fact is that Korean parsers very often and systematically resolve sandwiched dative NP as shown in (1a). This study shows that the answer for this puzzle can be found in the pro-active use of prosody. This study presents the results of (i) off-line auditory fragment completion (ii) prosodic phrasing and subsequent comprehension test and (iii) on-line self-paced word-by-word reading. In the off-line auditory fragment completion, two different auditory inputs were given as in (2a) and (2b). % refers to the Intonational Phrase boundary, which has final lengthening and a boundary tone (Jun 1993, 2000). When the auditory input is as in (2a), the subjects strongly preferred to complete sentences with transitive verbs. And when the input is as in (2b), the result was opposite. They preferred to complete sentences with ditransitive verbs. Similarly, in prosodic phrasing, subjects produced a significantly longer boundary before the sandwiched dative NP in (3a). In (3b), subjects produced a longer IP boundary before a sandwiched dative when they resolved the sandwiched dative as in (1a). Yet, they produced longer a IP boundary after the sandwiched dative when they resolved it as in (1b). This result supports the Implicit Prosody Hypothesis (Fodor 1998). In on-line self-paced reading, significant delay was observed in region 6 of (4a) relative to the same region in (4b), similar to previous findings of Koh (1997) and Kamide & Mitchell (1999). Based on these results, I argue that what self-paced reading can show us about processing Korean is limited because prosody, which is crucial in real-time understanding, is ignored.

Examples

(1) NP-nom NP-dat NP-nom gave-REL NP-acc Adv ditransitive verb

a. [NP-nom] [NP-dat NP-nom gave-REL NP-acc] Adv ditransitive verb: Dative NP in the Relative Clause

b. [NP-nom NP-dat] [NP-nom gave-REL NP-acc] Adv ditransitive verb: Dative NP in the Matrix Clause

(2) Auditory Fragment Completion

a. {NP-nom} % {NP-dat NP-nom gave-REL NP-acc...   (e.g., Transitive / Ditransitive)

b. {NP-nom NP-dat} % {NP-nom gave-REL NP-acc…   (e.g., Transitive / Ditransitive)

(3) Prosodic Phrasing

a. NP-nom NP-dat NP-nom gave-REL NP-acc Adv Transitive Verb

b. NP-nom NP-dat NP-nom gave-REL NP-acc Adv Ditransitive Verb

(4) Self-paced reading (number refers to the region)

a. NP-nom(1) NP-dat(2) NP-nom(3) gave-REL(4) NP-acc(5) NP-dat(6) ditransitive verb (7)

b. NP-nom(1) NP-dat(2) NP-nom(3) gave-REL(4) NP-acc(5) Adv(6) ditransitive verb (7)

P600 effects elicited by non-grammatical linguistic anomalies: Evidence for a general processing response to orthographic, phonological, and syntactic anomalies

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ERP studies of sentence comprehension often report that grammatically anomalous words elicit a slow positive wave (P600). This is typically associated with grammatical processing. However, some studies have reported P600-like effects for misspelled words (Munte *et al.*, 1998; Vissers *et al.*, 2005), calling into question grammar-specific functional interpretations of the P600. Vissers *et al.* argue that the P600 reflects a re-processing response, which occurs not only to grammatical anomalies but to a wider class of unexpected linguistic events.

We recorded ERPs from 19 channels as participants (N=20) read sentences containing two types of non-grammatical anomalies. In one study, subjects read pseudo-words in contexts that made them resemble misspelled real words, e.g., "The baseball player caught the baul …", or in "neutral" contexts, e.g., "The experienced chef sliced the baul …". Pseudo-words elicited a large P600-like positive shift in misspelling contexts but elicited an N400 effect in neutral contexts. This replicates and extends earlier findings for pseudowords.

In a second study, subjects read phonological-orthographic (but non-grammatical) anomalies, exemplified by "She read a article" and "She read an book." These sentences violate an English phonological-orthographic regularity that "a" and "an" are followed by consonant- and vowel-initial words, respectively. Such violations elicited a centro-parietally maximal P600-like positive deflection at the noun, beginning around 500 msec post word-onset and continuing for over 500 msec.

We agree with Vissers *et al.* that the functional antecedents of the P600 appear to extend beyond grammatical anomaly. Furthermore, our data are consistent with previous suggestions that P600 and P300 effects are fundamentally related (Coulson *et al.*, 1998). However, we emphasize that accounts of the P600 in terms of the "unexpectedness" of linguistic events (e.g., Coulson *et al.*, 1998) are underspecified. Some unexpected linguistic events, including semantic anomalies and pseudowords, elicit N400, not P600. We suggest that P600 effects will be elicited by a wide range of violated expectations about how basic units of linguistic form, including phonemes, orthographic units, and grammatical morphemes, *combine* at multiple levels. Critically, words that respect regularities of linguistic form but violate semantic expectations will elicit N400. That is, there appears to be a fundamental processing distinction, evidenced in the ERP data, between regularities of *form* and *meaning*. And the notion of form required here cuts across standard linguistic distinctions such as that between grammar and phonology.

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The mechanism(s) underlying parallelism: eye-tracking coordinate structures in German

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Previous research has shown that processing the second of two conjoined elements is facilitated if both elements are structurally parallel. It has been proposed that several mechanisms contribute to this "parallel-structure effect", in particular, as self-paced reading studies found differences in parallelism effects depending on markedness, and ambiguity (e.g., Frazier et al., 1984).

We present two eye-tracking experiments that extend these findings by investigating the interactions of parallelism with markedness (Experiment 1) and ambiguity resolution (Experiment 2). A global parallelism mechanism would predict facilitative effects independently of markedness or ambiguity. Interactions with one of these two factors would suggest a more local strategy, and provide insights into the nature of the mechanism(s).

Experiment 1 investigated the effects of clause-level parallelism and markedness on the processing of unambiguous coordinate clauses. Sentences (1a/c) had parallel clausal constituent order, (1b/d) were non-parallel. Sentences (1a/d) had a subject-initial second clause (unmarked); (1c/d) were object-initial (marked). An analysis of 32 participants revealed a main effect of parallelism (ps < 0.02), and markedness (ps < 0.001) in total times on the first NP of the second clause ("der/den Gendarm"), but no interaction of the two factors (ps > 0.2). Total reading times for parallel conditions (1a/c, 925) were lower than for non-parallel conditions (1b/d, 1085). Subject-initial second clauses (1a, 816 ms; 1d, 920 ms) triggered lower total reading times than object-initial second clauses (1b, 1249 ms; 1d, 1034 ms). These findings suggest a priming-like parallelism mechanism that facilitates processing independently of markedness.

Experiment 2 examined the influence of parallelism on structural preferences in ambiguous contexts. We investigated the effects of NP-internal parallelism on the processing of locally structurally ambiguous/unambiguous sentences. Sentences had S-V-O-coord-NP3… structure, where NP3 was either a conjoined object, or the subject of a conjoined sentence. The determiner on NP3 either disambiguated via case marking (unambiguous) or not (ambiguous). Adjectival modifiers established an NP-internal parallelism between NP3 and either the subject or object of the first clause. Sentences were matched for length and frequency.

Regression path durations on the NP3 region ("geniale Tänzerin/begabte Komiker") showed a main effect of ambiguity (ps < 0.01), a significant interaction between ambiguity and parallelism bias (ps < 0.01), but – unlike Experiment 1 - no main effect of parallelism bias (ps > 0.2). Ambiguous sentences triggered shorter regression path durations than unambiguous ones. Ambiguous object-parallel (2a, 820 ms) differed from subject-parallel sentences (2b, 699 ms), suggesting a facilitation when both clausal and NP internal structures were parallel. Regression path durations did not differ significantly for unambiguous sentences (2c/d), suggesting no benefit of parallelism when case marking disambiguates.

In conclusion, results from Experiment 1 support a globally facilitative effect of parallelism on processing. Findings in Experiment 2 suggest that several factors, including parallel structure, may conspire to facilitate processing in ambiguous contexts.

Examples

1a.Gestern foppte der Gärtner den Pförtner und heute verspottet der Tischler den Butler...
Yesterday hoaxed the gardener (S) the janitor (O) and today mocks the joiner (S) the butler (O) ...

1b.Gestern foppte der Gärtner den Pförtner und heute verspottet den Tischler der Butler...
Yesterday hoaxed the gardener (S) the janitor (O) and today mocks the joiner (O) the butler (S) ...

1c.Gestern foppte den Gärtner der Pförtner und heute verspottet den Tischler der Butler...

1d.Gestern foppte den Gärtner der Pförtner und heute verspottet der Tischler den Butler...

2a. Der Kritiker rühmt den begabten Komiker und die geniale Tänzerin …
The critic (S) praises the gifted comedian (O) and the ingenious dancer (amb,O-bias) ...

2b. Der bekannte Kritiker rühmt den Komiker und die geniale Tänzerin …
The renowned critic (S) praises the comedian (S) and the ingenious dancer (amb,S-bias)..

2c. Der Kritiker rühmt die geniale Tänzerin und der begabte Komiker …

2c. Der bekannte Kritiker rühmt die Tänzerin und der begabte Komiker …

Local syntactic coherences in sentence processing

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Tabor, Gallantucci, & Richardson (2004) provided evidence for the dynamical system view of language processing, which predicts that sentence processing complexity is not only a function of the globally grammatical structure but also a function of interfering locally coherent but globally ungrammatical sub-parses. Their interpretation was recently questioned by Gibson (in press) who suggested the data support the hypothesis that top-down and bottom-up (unigram) lexical statistics interact in syntactic ambiguity resolution and are thus compatible with standard parsing frameworks. Crucially, all experiments so far included lexically ambiguous materials. In the present paper, we present anomaly detection experiments with ungrammatical sentences without lexical ambiguities (1-4).

All experimental target materials contained an additional NP following the verb of the relative clause, which rendered the sentence ungrammatical. The rationale is that if local coherences are processed during sentence processing, global syntactic violations that are nevertheless locally consistent with a false expectation (i.e., locally coherent, 2,4) should be harder to detect than anomalies that are both global and local (1,3). Such an effect would be hard to reconcile within a standard parsing framework, but would be predicted by dynamical systems.

Locally coherent continuations were derived from stable error patterns found in simulations with Simple Recurrent Networks (SRNs, Elman, 1990). The SRNs were trained with a small subset of German, including subject- (SRCs) and object-extracted relative clauses (ORCs). Even after extensive training, they showed errouneously high activation of locally coherent, but globally incorrect nodes (false-alarms) at the end of RCs.

In the experiments, sentences were presented in a word-by-word rapid serial visual presentation (RSVP) fashion. The participants were instructed to press a button as soon as they noticed an error in the sentence. The time between the onset of the first erroneous word (*der* or *den*) and pressing the button was recorded as anomaly detection (AD) time.
The results indicate that local coherences do interfere with processing. For ORCs, however, only the group with the most experienced readers showed a significant higher AD time in the locally coherent sentences. The results can be seen as an indicator of the psychological reality of local coherence processing even in the absence of lexical ambiguity. The fact that the coherency effect is restricted to SRCs for all but the more experienced readers apparently suggests an interaction with working memory capacity: Since ORCs are too demanding for less experienced readers, they have no sufficient resources available for a parallel locally coherent analysis. When available, as in SRCs or, for highly experienced readers even in ORCs, a local coherence does indeed affect AD times.

Examples

(1) SRC, incoherent
Der Abgeordnete, der den Journalisten beschimpft *[den Politiker], liefert die Beweise.
*The congressman, who*nom *the journalist*acc *attacks *[the politician]*acc*, delivers the evidence.*

(2) SRC, coherent
Der Abgeordnete, der den Journalisten beschimpft *[der Politiker], liefert die Beweise.
*The congressman, who*nom *the journalist*acc *attacks [the politician]*nom*, delivers the evidence.*

(3) ORC, incoherent
Der Abgeordnete, den der Journalist beschimpft *[der Politiker], lieferte die Beweise.
*The congressman, who*acc *the journalist*nom *attacks *[the politician]*nom*, delivers the evidence.*

(4) ORC, coherent
Der Abgeordnete, den der Journalist beschimpft *[den Politiker], liefert die Beweise.
*The congressman, who*acc *the journalist*nom *attacks *[the politician]*acc*, delivers the evidence.*

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Intermediacy of Grammatical Representation: Evidence from Spectrographic Analysis of Sentences Read Out Loud

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Serial and constraint-based theories of sentence processing make divergent predictions about garden path sentence processing. The standard Garden Path model (e.g., Frazier & Rayner, 1982) contends that readers always select an erroneous parse in the ambiguous region of a garden path sentence, and that they always show difficulty at disambiguation. Probabilistic serial models (e.g., Van Gompel et al, 2001) allow that readers avoid garden pathing some proportion of the time, and are completely garden pathed the rest of the time. By contrast, constraint-based theories claim that the mind is sometimes in intermediate states. Some such proposals (e.g., Christianson et al., 2001; Tabor et al., 2004) maintain that the system can, at least temporarily, build hybrid tree structures which are not grammatically self-consistent and compromise between conflicting constraints.

We hypothesized that this kind of intermediacy would be detectable in the speech patterns of sentences read aloud. A relatively unexplored methodology, reading out loud is comparatively naturalistic: sentences are presented in full and participants are encouraged to pronounce them as if reading a story. Speech recordings allow for case-by-case analysis of subject data (for example, on a given trial one can *hear* a subject stutter at disambiguation). Moreover, the speech signal contains a unique richness of data, including between-word pause information, not available from eye-tracking or self-paced reading.

Subjects in this study were asked to read aloud sentences containing a temporarily ambiguous NP (1). A fluent reading usually involves a long pause prior to the ambiguous NP, *the boxes*, (Pause1), and a short pause between the ambiguous NP and the disambiguating second verb (Pause2). By contrast, a garden path reading involves a short Pause1, and a long Pause2. We predicted that readers would sometimes treat the NP as both the direct object of the first verb and the subject of the second one, thus pausing only briefly in both cases.

Methodology. Whole sentences were visually presented (one at a time), and each subject was recorded during reading. (We plan a follow-up with simultaneous eye-tracking).

Results. We normalized pause lengths (derived from spectrograms) by individual trial reading speeds. A graph of Pause2 versus Pause1 exhibited a pronounced L-shape, with most of the data concentrated near the origin (both pauses being short). The remainder were distributed along the Pause1 and Pause2 axes, corresponding, respectively, to the non-garden path and garden path readings. The pitch contours in the both-short cases showed indications of hybrid behavior as well: rather than the falling intonation associated with phrase completion, many trials showed a flatter intonation similar to the main clause continuation. We argue for simultaneous attachment of the NP in two places, and against an account which posits discrete representation at the grammar level and blending only at the articulation level: such an account must tell a complex story about how the second parse gets linked up with the words already spoken. Finally, the reading aloud methodology may help address a wide range of questions about the subtle temporal dynamics of parsing.

Example

(1) *When the worker moved the boxes fell suddenly from the shelf.* (comma intentionally omitted).

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Getting the arguments right: the interaction between syntactic and semantic word order preferences in sentence processing

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In psycholinguistic research numerous comprehension studies have shown a strong preference for subject-before-object (SbO) over object-before-subject (ObS) structures, as well as an animate first preference. These two preferences coincide if animate NP is the subject of a sentence, which is typical for sentences with transitive agentive verbs assigning the role of agent to the subject of an active sentence (1a). However, if a causative or unaccusative psych verb is used, a conflict between these two preferences might occur. Psych verbs assign the role of experiencer to object, and thus select an animate object, whereas the subject/theme can either be animate or inanimate. To investigate the interplay between structural and semantic word order preferences we performed two experiments in Dutch.

In the first study participants rated the ease of comprehensibility of embedded clauses with a local structural ambiguity (SbO/ObS) manipulating the animacy word order (i.e. animate-inanimate, inanimate-animate) combined with an agentive verb (1a,b), a causative (2a,b), or an unaccusative psych verb (3a,b). The results showed that, independent of verb type, SbO-sentences were easier to comprehend than the ObS-sentences. The ObS-sentences with the inanimate-animate word order (1b) were most difficult to comprehend, whereas the sentences with the animate-inanimate word order (2b, 3b) were relatively easy. This indicates that the animacy word order and/or the differences between the verbs influence the comprehension of the ObS-structure. To disentangle these two factors we performed an ERP-reading study using the same materials.

The differences in ERP-waveforms showed a clear effect of animacy word order. At the second NP an positive shift in approximately the same time frame as the P200 was found for the less common and less preferred inanimate-animate word order. This effect is taken as evidence for the early influence of animacy information in sentence processing.

At the verb, the point of disambiguation, a complex pattern of effects was found. For the SbO-structures a late positive shift was found for the two types of psych verbs (2a, 3a) in comparison to the agentive verbs (1a), whereas for the ObS-structures only the unaccusative psych verbs (3b) showed a late positivity. Furthermore, different patterns of effects were found between SbO- and ObS-structures for each verb type separately. The ObS-sentences with the agentive verbs showed a negativity in the same time frame as the N400, broadly distributed over the scalp (1b vs. 1a). A similar effect followed by a late positive shift was found for causative psych verbs(2b vs. 2a). Except for a small negativity at anterior sites, no differences were found between the two structures with the unaccusatve psych verbs (3a,b). We will argue that these ERP-effects reflect the influence of animacy word order causing differences in the expectation and lexical integration of the verbs, as well as differences in structure reanalysis involving the (re)assignment of thematic roles and syntactic functions.

Examples

1a.   Dat de voetballer de overtreding expres beging …   <agentive, SI, anim-inanim>
    that the soccer player the fault deliberately committed …
  b.   Dat de overtreding de voetballer expres beging …   <agentive, OI, inanim-anim>
    that the fault the soccer player deliberately committed …

2a.   Dat de overtreding de voetballer ernstig schokte …   <causative, SI, inanim-anim>
    that the fault the soccer player seriously shocked …
  b.   Dat de voetballer de uitlating ernstig schokte …   <causative, OI, anim-inanim>
    that the soccer player the fault seriously shocked …

3a.   Dat de overtreding de voetballer meteen opviel …   <unaccusative, SI, inanim-anim>
    that the fault the soccer player immediately noticed…
  b.   Dat de voetballer de overtreding meteen opviel …   <unaccusative, OI, anim-inanim>
    that the soccer player the fault immediately noticed

An incremental minimalist parser

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This paper introduces a new incremental language modeling parser based on the Minimalist Program (MP) for its syntactic representation (Chomsky, 1995). The system was developed within the framework of a symbolic, rule-based, goal-directed cognitive modeling approach (Newell 1990) and machine learning architecture (Laird et al. 1987) that models on-line human language processing. The syntactic modeling component is a reimplementation of an earlier component whose syntax was loosely based on Government and Binding (or Principles and Parameters) theoretical assumptions. The earlier system's performance correlated highly with prior psycholinguistic findings in human language processing (Lewis 1993). In this paper we explore how the theoretical and practical considerations of the MP mesh with the system's pre-existing architectural assumptions.

Incremental parsing is predicated on a previous lexical access stage for each incoming word. Projecting lexical items, forming constituents, and linking together potential constituents in the new system now require more information regarding thematic grids than previously used; we discuss, for example, the use of WordNet (http://www.cogsci.princeton.edu/~wn) and EngLCSLex (http://clipdemos.umiacs.umd.edu/englcslex/title.html) data. Strategies for merging syntactic structures, constraint checking, and ambiguity representation have required reformulation for the MP, sometimes considerably. An architectural feature introduced by Lewis is the assigners/receivers set, which tracks how many constituents on each category are active at any moment during the parse. An MP parse with its additional layers of structure (e.g. the VP shell) entails additional implications for this structure; for example, limited, local structural reanalysis for unproblematic ambiguities is substantially impacted.

We also discuss semantic interpretation, which involves mapping ongoing syntactic substructure to incrementally expanding semantic representations: the MP offers crucial information for deriving more abstract semantic information than we have been able to generate before.

Finally, we touch on several other relevant aspects of the system's abilities to simulate on-line language processing. For example, the system is capable of learning strategies and chunking up prior experience; this has interesting implications for operationalizing the learning of minimalist parsing decisions. We also discuss memory usage during incremental parsing, relating it to previous work with the prior syntactic approach and other systems.

This paper, then, argues for the appropriateness of, and challenges with, using the MP in the parsing component for a language modeling system. The nature of the tight integration—within one architecture—of all processing modalities, from lexical through semantic, is situated within the theory. Strengths and weaknesses of the approach are mentioned, and prospects for further research and investigation are discussed.

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Implicit Prosody effects on the attachment of attributes to NPs in Brazilian Portuguese

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The Implicit Prosody Hypothesis – IPH (Fodor, 1998, 2002) predicts that prosody is mentally projected by readers onto written word strings and can affect syntactic ambiguity resolution. The present study provides evidence of Brazilian Portuguese (BP) prosodic patterns in oral production and shows that these patterns can predict attachment preferences in the parsing of sentences in reading.

Some adjectival constructions in Brazilian Portuguese can be ambiguous between interpretations in which the attribute is locally or non-locally attached, as exemplified in (1), where the attribute *suado* "sweating" can refer to the high subject NP or to the low object NP. As both constructions display equivalent structural complexity, disambiguation preferences for this construction should follow the Late Closure Principle which predicts that local attachment should be favored. The present study examined the reading comprehension of 24 sentences as (1), interspersed among 48 fillers, in an off-line interpretation task. Sentences were presented on a computer screen to four groups of 10 subjects in four modes: (a) full sentences for silent reading; (b) full sentences for loud reading; (c) sentences presented in two screens with a break after the verb (example 2); (d) sentences presented in two screens with a break after the object NP (example 3). Subjects controlled the noncumulative presentation of sentences or sentence segments by pressing the space bar and immediately after each sentence were asked to choose between two interpretations, as exemplified in (a) and (b), by pressing the "a" or the "b" button in the keyboard. The oral production in the loud reading of full sentences indicated that there is a correlation between a portfolio of prosodic cues (silent pause, vowel lengthening, intonation) and the attachment interpretation decision.

Results of the interpretation task indicated that there are significant interactions between segmentation type and high and low attachment in comparison with the non-segmented condition. Decision rates for non-segmented sentences show a significant preference for low attachment, following the Late Closure Principle (71.2%, p= 0.000). Segmentation after the verb significantly increases low attachment rates (81.2%, p=0.010) and segmentation after the object NP significantly decreases low attachment rates (60.4%, p = 0,012), as predicted by the IPH. Additionally, interpretation results for full sentences favor low attachment and do not differ across the oral vs. silent reading factor (66.25% vs. 71.25%, p = 0.237). Interestingly, decision rates for non-segmented sentences in which there is no implicit prosody manipulation fall between the two segmented conditions. Decision times are overall higher (tendency only) for non-segmented than for segmented sentences since the former displays no segmentation cues for the attachment decisions. In summary, our data suggest that segmentation provides reliable cues for prosodic boundaries: results are exactly as predicted if readers treat segment boundaries as signaling prosodic boundaries. Thus, the IPH offers an elegant explanation of the findings.

Examples

(1)   O rapaz abraçou o amigo suado.

(2)   O rapaz abraçou / o amigo suado.

(3)   O rapaz abraçou o amigo / suado.

 The boy hugged the friend sweating

(a) o rapaz estava suado (b) o amigo estava suado

(a) the boy was sweating (b) the friend was sweating

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Distance of integration and antecedent complexity in the online interpretation of VP-ellipsis

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Two speed-accuracy trade-off (SAT) experiments investigated the retrieval and interpretation processes underlying the on-line comprehension of verb-phrase ellipsis. The SAT procedure provides conjoint measures of 1) the probability that comprehenders successfully converge on an interpretation and 2) the speed with which the interpretation is computed (e.g., McElree, Foraker, & Dyer, 2003). To determine whether antecedents are retrieved with a search mechanism or a content addressable mechanism (in which cues make contact with memory representation without a search process), we manipulated the amount of interpolated material (distance) between the antecedent and the ellipsis site (1a and 1b). A search mechanism predicts that retrieval speed should slow as distance increases, whereas a content addressable mechanism does not (McElree, 2000; McElree et al., 2003). To determine whether the interpretation of ellipsis involves a 'copy' mechanism (e.g., Frazier & Clifton, 2001), the overall complexity of the antecedent was manipulated (2a and 2b). If the antecedent must be copied into the ellipsis site, then interpretation speed should slow as complexity increases.

In Experiment 1, we found that near antecedents (1a) were interpreted more accurately than distant antecedents (1b), but both near and distant antecedents were retrieved with comparable speed. Lower accuracy for distant antecedents likely reflects the general effects of retroactive interference. Comparable retrieval speed is inconsistent with a search mechanism and suggests that antecedents were accessed with a content-addressable operation.

In Experiment 2, we found a non-significant trend for complex antecedents to be interpreted more accurately than simpler antecedents, possibly due to increased saliency (or shorter distance from the ellipsis site). However, there was no evidence to suggest that complexity slowed interpretation speed, a finding that is inconsistent with a copy mechanism. Rather, the results suggests that the interpretation of VP-ellipsis should be viewed as being functionally equivalent to a pointer system, in which the ellipsis serves as a pointer to extant structures in the comprehender's discourse memory.

However, a pointing mechanism may not suffice when the interpretation of the ellipsis requires rebinding of variables within the antecedent (e.g., "The woman knew who to invite to the party, but her husband did not"). A third SAT experiment is currently under way to determine whether these types of structures have measurable effects on comprehension speed. A positive finding would indicate that a pointer mechanism might not be operative in all types of ellipsis.

Examples

Near Antecedent 1a) The editor admired the author's writing, but the critics did not.

Distant Antecedent 1b) The editor admired the author's writing, but everyone at the publishing house was shocked to hear that the critics did not.

Simple Antecedent 2a) The history professor understood Roman mythology, but the chairman was disappointed to hear that the students attending summer session did not.

Complex Antecedent 2b) The history professor understood Rome's swift and brutal destruction of Carthage, but the students attending summer session did not.

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Children can be better than adults at using prosody to resolve syntactic ambiguity: Japanese children's use of prosody in the interpretation of prenominal modifiers

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Recent research on children's use of prosodic cues in sentence processing has shown that 4- and 5-year old children are capable of using prosodic cues to interpret ambiguous sentences. But when other cues (such as lexical bias) contradict the prosody, children seem to be more willing than adults to let the other cues override the prosodic cues. This could be either because (i) children as a rule rely less on the prosodic cues (relative to other cues) than adults, or because (ii) their relative reliance on prosodic cues may vary in different ways than adults. If the first is correct, we expect children's reliance to prosody to be consistently less than that of adults, while the second view predicts that we may find specific cases where children rely on prosody more than adults.

In the present study, we tested Japanese children's interpretations of prenominal modifier ambiguity. Four- and 5-year old children and adults were presented with NPs having two prenominal modifiers, as in (1). The NPs were ambiguous between left-branching (LB, 1a) and right-branching (RB, 1b) interpretations, depending on the prosody. Half of the sentences consisted of unaccented words (1), while the other half used only accented words (2). For adult Japanese, the LB interpretation is generally preferred. Picture selection tasks with four alternative pictures were prepared. Two of the four pictures matched either the LB or the RB interpretation of the stimuli, while two other distracters were added to make the picture selection task felicitous.

To make sure the stimuli were reliable, LB and RB versions of the stimuli (differentiated by prosody) were first presented in pairs to a group of Japanese adults. When they were asked to choose pictures that matched the auditory stimuli, they were 100% correct. In the main experiment, a different group of Japanese adults and two groups of Japanese children (ages 4 and 5) were presented with NPs in two blocks — 12 NPs with LB prosody in the first block, and 12 NPs with RB prosody in the second block, or vice versa.

Results showed that 4-year old children were able to choose correct pictures about 63% of the time for RB prosody while they were at chance level for LB prosody. Five-year old children were over 75% correct for both LB and RB prosody when it was presented in the first block. They were no better than chance in the second block (basically, they had problems switching from one to the other). Adults were 100% correct with LB prosody, but only 59% correct with RB prosody, independent of which came first. No effect of lexical accent was found.

Although the children's performance demonstrated limitations typical for their age (e.g., 5-year olds' inability to switch their responses in the second half), children were able to use RB prosody more reliably than adults when interpreting ambiguous prenominal modifiers. The results are consistent with the view that the importance of prosodic cues in relation to other cues may sometimes be different from adults, in such a way that children may be better at using prosody than adults in some conditions. The stronger preference for LB for adults may be learned through experience with the language.

Examples

(1) a.   Left-Branching, with unaccented lexical items
      [akai   hana–no]   [osara]
       Red   flower   dish
      "A dish with red flower pattern"

   b.   Right-Branching, with unaccented lexical items
      [akai]   [hana–no   osara]
       Red   flower   dish
      "A red dish with a flower pattern"

(2) a.   Left-Branching with accented lexical items
      [MIdori-no   RIbon-no]   [KAsa]
       green   ribbon   umbrella
      "An umbrella with green ribbons"

   b.   Right-Branching with accented lexical items
      [MIdori-no]   [RIbon-no   KAsa]
       green   ribbon   umbrella
      "Green umbrella with a ribbon pattern"

Bilingual relative clause attachment. Are there L1 and L2 processing differences?

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Research with ambiguous constructions of the type NP1-prep-NP2-RC (1) has shown that there is cross-linguistic variation on the preferred landing site for the attachment of the relative clause (e.g., Cuetos & Mitchell, 1988; Brysbaert & Mitchell, 1996; Zagar & Pynte, 1993), suggesting that the Late Closure principle (LC), which predicts local attachment for this construction, is not universal. The present study makes use of this cross-linguistic variation in order to investigate the processing strategy employed by bilinguals whose first and second language disagree on the relative clause attachment preference. It has been shown that, in off-line tasks, native speakers of Brazilian (BP) Portuguese exhibit high attachment preferences for long RCs (Finger & Zimmer, 2002; Lourenco-Gomes, 2003). In contrast, English native speakers demonstrate either low or no attachment preference (see Fernandez, 2005 for a review). In a preliminary off-line questionnaire task, monolingual speakers of BP (N=32) and bilingual speakers (N=32) of BP (L1) and English (L2) were presented with sentences such as in (1), followed by an interpretation question. Bilinguals first received the English version of the questionnaire, followed by the Portuguese version a week later.

(1)   a.   The plumber fixed the pipe of the sink that was cracked.
               What was cracked? [ ] the pipe [ ] the sink

        b.   O bombeiro consertou o cano do tanque que estava rachado.
               O que estava rachado? [ ] o cano [ ] o tanque

We found that BP monolinguals exhibit preference for the high attachment of RC, supporting previous results. Bilinguals, however, show low attachment preference for their L2 (t1 (31)=7.59, p< .05; t2 (23)=5.15, p< .05), being consistent with that of native English speakers. They also exhibited different behavior on the processing of their L1, showing no attachment preference, significantly differing from monolinguals (F1 (1,62)=5.90, p< .02; F2(1,46)=10.84, p< .002). Results show that bilinguals do not employ the same strategies for both languages. Taking into account monolinguals preferences, this pattern of different behavior for L1 and L2 has only been reported for bilinguals whose L1 shows preference for high attachment and L2 shows preference for low attachment ,e.g. Spanish-English bilinguals (Dussias, 2001) and Portuguese-English bilinguals (Maia & Maia, 2005). However, the same pattern is not obtained with speakers whose L1 exhibits low attachment preference and L2 exhibits high attachment preference, e.g. English-Spanish bilinguals (Fernandez, 2003).

ERP correlates of filler-gap integration costs in Mandarin

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In this paper we provide ERP evidence demonstrating how verb selectional restrictions (c-selection, s-selection) are satisfied by the integration of the relative clause head and the relative clause marker *de* in Mandarin Chinese.

Previous research on filler-gap processing has demonstrated a P600 component effect associated with long-distance integration costs (e.g., Felser et al. 2003, Phillips et al. 2005). In Mandarin, subject-gap relatives (as in 1) are more difficult to process than object-gap relatives (as in 2), because of greater integration costs due to the longer distance between gap and filler in the subject-gap relatives (Hsiao and Gibson 2003). The research question we sought to address therefore was whether we would observe a P600 component effect reflecting increased integration costs for the more difficult subject-gap relatives. To address this question, we collected ERP data from twenty Mandarin speakers as they read 240 sentences consisting of object- and subject-gap relatives embedded in subject and object positions of matrix sentences.

When the subject- and object-gap relative clauses were compared, the result for relatives in matrix subject position was a significantly greater P600 component for the subject-gap relatives, with left and central scalp distribution, located at the marker *de*. For relative clauses in matrix object position, the result was a significantly greater P600 once again for the subject-gap relatives, with central distribution, this time located at the relative clause head.

We explain the P600 effect at the marker *de* for relatives in matrix subject position (as in 3) by positing that within the relative clause, the verb c-selects a noun (in 3, *Mali* 'Mary') as its complement, which is immediately integrated (i.e., the c-selectional restriction of the relative clause verb is immediately satisfied). That verb also s-selects (i.e., theta-assigns) theta roles (e.g., in 3, the agent role represented by the subject gap and the patient role represented by the object *Mali* 'Mary'), but the theta assignment of the gap is not satisfied until the marker *de* is integrated, resulting in the observed P600 effect on *de*.

The P600 effect does not occur at the marker *de* for relatives in matrix object position (as in 4) because when *de* is integrated, it satisfies the c-selectional and s-selectional restrictions of the 'higher' matrix verb (*zhuile* 'chased' in 4) rather than the embedded relative clause verb. No P600 effect is observed when *de* is integrated because matrix verb processing is not subject to a gap-filler distance effect. The selectional restrictions of the relative clause verb are satisfied instead when the head noun (*gou* 'dog' in 4) is integrated, resulting in the observed P600 effect there.

Based on these results, we argue that: (1) a single integration may satisfy multiple selectional restrictions (both c-selection and s-selection) from a single verb, but cannot satisfy selectional restrictions from two different (e.g., matrix and embedded) verbs, (2) in a Mandarin relative clause, both the relative marker *de* and the relative clause head may satisfy the selectional restrictions of the relative clause verb, and (3) Mandarin demonstrates a non-local attachment preference for the integration of the relative marker *de* (because it satisfies the selectional restrictions of the higher matrix verb rather than those of the local embedded relative clause verb) in the parsing of relative clauses in matrix object position.

Examples

1. $\emptyset_i$ xihuan Mali de   gou$_i$ 2. Mali xihuan $\emptyset_i$ de   gou$_i$
      $\emptyset$ like   Mary REL dog   Mary like $\emptyset$ REL dog
      'the dog that likes Mary'   'the dog that Mary likes'

3.   [$\emptyset_i$ xihuan Mali de   gou$_i$] zhuile   San   4. San zhuile   [$\emptyset_i$ xihuan Mali de   gou$_i$]
      $\emptyset$ like   Mary REL dog chase-ASP San   San chase-ASP $\emptyset$ like   Mary REL dog
      'The dog that likes Mary chased San'   'San chased the dog that likes Mary'

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Focus assignment in reading

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Although Jackendoff (1972) identified focus assignment as an important aspect of semantic interpretation, rather few psycholinguistic studies have examined how focus is assigned during sentence processing (e.g., Birch & Rayner, 1997). The present studies investigated the interplay between discourse context and structural restrictions on focus assignment for sentences containing the particle "only". This particle specifies a contrast between the referent of a focused sentential constituent and some alternatives (e.g., Rooth, 1992). Thus, to interpret a sentence containing "only", the reader must identify the focused constituent that forms the contrast and determine the nature of its alternative. Previous research by Liversedge, Paterson, Filik, Juhasz, White and Rayner, (under review) suggested that there are structural restrictions requiring that "only" (a) focuses on constituents that it c-commands in the parse tree, and (b) preferentially focuses on an adjacent constituent within this syntactic domain. The present experiments investigated whether discourse context can over-ride these structural restrictions.

Liversedge et al. recorded eye movements as participants read sentences like (1) and (2), with "only" preceding either the direct object (e.g., "the salt") or the indirect object (e.g., "her mother") and a replacive continuation (e.g., "but not the pepper / her father") supplying a contrast for either the direct or indirect object. Consistent with the structural restrictions on focus assignment described above, Liversedge et al. found that reading times at the post-replacive region were longer when the replacive was incongruous with the constituent that "only" directly preceded. That is to say, reading times were longer when "only" directly preceded the direct object but the replacive was congruous with the indirect object, and vice versa.

The present experiments extended these findings, by examining whether using an interrogative context containing either a "who"-phrase (e.g., 3) or a "what"-phrase (e.g., 4) to project focus onto either the direct or indirect object of a ditransitive sentence could over-ride the focus assignment preferences associated with "only". "Who"-phrases focused on the indirect object whereas "what"-phrases focused on the direct object. Interrogative contexts were followed by a ditransitive sentence with "only" preceding either the direct object (Experiment 1) or the indirect object (Experiment 2). Experiment 1 reading times were longer when the replacive was incongruous with the interrogative context, irrespective of whether it projected focus onto the direct or indirect object. Thus, the Experiment 1 reading times indicated that context could over-ride the preference for assigning focus to an adjacent constituent. However, in Experiment 2 the reading times for the post-replacive region were longer when the replacive was incongruous with the indirect object, irrespective of the interrogative context, indicating that when "only" preceded the indirect object, context did not over-ride the syntactic requirement for it to focus on this constituent. Thus, the results demonstrate that whereas the preference for assigning focus to an adjacent constituent is violable, syntactic restrictions on focus assignment are not.

Examples

1. At dinner, Jane passed only the salt to her mother but not [the pepper / her father] as well because she couldn't reach.

2. At dinner, Jane passed the salt to only her mother but not [the pepper / her father] as well because she couldn't reach.

3. Her sister wondered who Jane would pass the salt to at dinner.

4. Her sister wondered what Jane would pass to her mother at dinner.

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Individual differences in syntactic reanalysis

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Ambiguity is prevalent in human language (Frazier, 1987; MacDonald, et al., 1994). It is often assumed that ambiguous structures are reanalyzed until the correct structure is realized or the parser determines that a correct analysis cannot be computed. Furthermore, it is also assumed that meaning can only be derived from a complete syntactic structure. However, Christiansen, et al. (2001) found evidence that partial reanalysis often occurs. In their study, participants were given garden path sentences such as (1). Participants reliably and confidently answered "yes" to both comprehension questions (2) and (3). These results suggested that participants initially attached *the baby* as the direct object of *bathed*. When they read the disambiguating verb, they only **partially** reanalyzed the structure—they kept *the baby* as the object of *bathed* but also made it the subject of *spit up*. This methodology, however, has been questioned. The yes/no comprehension questions (see (3)) could have reinstated or strengthened the subjects' commitment to the initial structure and interfered with their ability to hold on to the correct, revised syntactic and semantic representation. Therefore, the present study used a paraphrasing methodology to eliminate the possible effects of probe interference.

The present study was also designed to look at individual differences in reanalysis. There is a reliable relationship between working memory and reading comprehension (e.g. Shah & Miyake, 1996). Reanalysis in sentence processing may also be related to individual differences in working memory. High spans may be more likely to inhibit the initial misinterpretation than low spans, thus, fully reanalyzing more often, consistent with the inhibition theory of working memory (Hasher & Zacks, 1988).

In the current study, 100 participants were presented with garden path sentences such as (1). Participants read each sentence, provided a grammaticality judgment, and then paraphrased the meaning of the sentence. In addition, half of the participants were in a **delay** condition. Those participants were asked to count backwards by 3s for thirty seconds before providing their paraphrase. Working memory was measured using the reading span task (Daneman & Carpenter, 1980). Our results showed the same amount of partial reanalysis as Christiansen et al. (2001), ruling out the possibility that the misinterpretation effect is due to the use of probe questions. Participants provided a paraphrase consistent with partial reanalysis half of the time, regardless of delay and working memory span. When participants were split into groups by span, high spans were more likely to fully reanalyze (undo their initial misinterpretation) than low spans; in contrast, low spans were more likely to fail to reanalyze (stick with the initial misinterpretation and ignore the main clause) than high spans. When participants were in a delay condition, they were more likely to forget the sentence or fail to reanalyze than when they were in the no delay condition. They were also more likely to fully reanalyze. However, delay did not interact with working memory span. These results provide further evidence that partial reanalysis does occur. They also suggest that working memory plays a significant role in reanalysis.

Examples

1) While Anna bathed the baby who was cute and cuddly spit up on the bed.

2) Did the baby spit up on the bed?

3) Did Anna bathe the baby?

Table 1. Proportions of Paraphrase Scores by Condition and Span Indicating:

	No Reanalysis	Partial Reanalysis	Full Reanalysis	Other
No delay				
High Span	.09	.62	.26	.03
Low Span	.24	.60	.15	.01
Delay				
High Span	.15	.39	.41	.06
Low Span	.26	.43	.23	.07

Implicit prosody effects in silent reading: Evidence from French

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In a previous study (Pynte, in press) imposed explicit prosodic phrasings were found to affect the comprehension of French PP constructions in a retrospective way (e.g., interpreting a PP as a verb vs. a noun complement may depend on the phrasing imposed to that part of the utterance located to the right of the critical PP). The aim of the present study was to extend this notion to *implicit* prosody (Fodor, 1998), and to examine whether retrospective phrasing effects can be found in silent reading. In both Examples (1) and (2), an implicit prosodic break can be expected at the main syntactic boundary in front of "is", thus producing a final 3-syllable implicit prosodic unit in (1'), or a final 5-syllable implicit unit in (2'). As a consequence, the implicit phrasing for the whole sentence may be adjusted retroactively (so that adjacent implicit prosodic units will have the same size, in terms of syllables), with the introduction of an additional implicit prosodic break in (1"), but not in (2").

(1)   Cooking pancakes with butter is easy

(1')   Cooking pancakes with butter [is easy]

(1")   Cooking pancakes [with butter] [is easy]

(2)   Cooking pancakes with butter is very easy

(2')   Cooking pancakes with butter [is very easy]

(2")   Cooking [pancakes with butter] [is very easy]

(3)   … cooking with oil …

(4)   … egg pancakes … (See the French examples below.)

The preferred interpretation for (1) and (2) was examined by presenting a second sentence in which a PP was associated to either "cooking" (Example 3) or "pancakes" (Example 4) (evidence for syntactic priming effects in comprehension is reported in Branigan et al., 2005). Two sentences were thus simultaneously displayed on the screen, and formed a single line of text. Participants were asked to carefully read them and to decide whether they formed a coherent text. Four conditions were compared, depending on whether sentence 1 was (1) or (2) and whether sentence 2 was (3) or (4). 24 different items (lexical contents) were used. 20 participants have been tested so far. Rejection rates were found to be lower in the 2+4 condition than in the 2+3 condition, which suggests that the PP was preferentially interpreted as a complement of "pancakes" in Example (2). Moreover, eye-movement data indicate that less regressions were initiated from the second sentence (and directed towards the first sentence) in the 1+3 condition than in the 1+4 condition, which suggests that the PP was preferentially interpreted as a complement of "cooking" in (1). These results provide further support to the Implicit Prosody Hypothesis and provide new insights concerning the time course of comprehension processes in silent reading (e.g., whether comprehension is incremental or whether some processing operations are delayed and/or whether initial interpretations are revised).

French Examples

(1)   La preparation des crepes au beurre est simple.

(2)   La preparation des crepes au beurre est très facile.

(3)   Leur preparation à l'huile l'est moins.

(4)   Celle des crepes aux oeufs l'est moins.

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What's beat got to do with it? The influence of meter on syntactic processing

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Auditory ERP-Data from patients with lesions (BG) or neurodegenerative change (PD) of the basal ganglia reveal that timing is crucial for syntax processing. As Friederici et al. (2003), Frisch et al. (2003) and Kotz et al. (2003) showed patients do not elicit a P600-component when presentation rate is random during syntactic processing. This applies to several syntactic violation types which evoke a P600 in healthy participants.

Recent evidence has demonstrated that external predictable rhythmic stimulation re-elicits the P600 in Parkinson patients during the auditory presentation of syntactically erroneous sentences (Kotz & Gunter, 2005). Based on these observations it is assumed that perceived metrical regularities of a given language should influence speech perception and, in turn, syntactic processing.

What may be metrical regularities of a given language? In the example of German, a stress-timed language, stressed syllables may form such metrical regularities. Consequently, we hypothesized that stressed syllables could be the predictable speech internal rhythmic marker influencing auditory syntactic processing. We constructed metrically regular sentences that were either grammatically, metrically, or doubly violated. Sentences only included words consisting of two syllables and first syllable stress (trochee), the default-meter in German. The grammatical violations were realized by morphosyntactic violations. Metrical violations were realized by putting stress on the second rather than first syllable of the critical item while sentences remained grammatically correct. Furthermore, double violations were syntactically as well as metrically erroneous (see example below).

Examples

Correct: 'Vera 'hätte 'Christoph 'gestern 'morgen **'duzen** 'können
"Vera could have adressed Christoph yesterday morning."

Syntax: *'Wilma 'hätte 'David 'gestern 'morgen **'duzte** 'können
*"Wilma could have **adress** David yesterday morning."

Meter: ''Detlef 'hätte 'Franzi 'gestern 'morgen **du'ZEN** 'können

Double: *'Hermann 'hätte 'Anke 'gestern 'morgen **duz'TE** 'können

If a trochaic meter works as a rhythmic pacemaker during auditory syntactic processing in German, the P600 should be elicited by metric as well as syntactic violations.

In a first study we tested 24 young healthy participants. Data was collected in two sessions. In one session participants judged metrical correctness, in session two they judged grammatical correctness (counterbalanced across participants).

In both tasks, all of the three manipulations elicited a P600. The latency of the P600 varied across the tasks. When information was processed explicitly, the P600 had an earlier onset than when information was processed implicitly. The data suggest that meter and syntax interact during auditory speech processing. This is supported by the fact that the amplitude of the P600 in the double violation condition did not vary compared to the amplitude in a single violation condition.

The current data will be discussed in the context of a domain-specific versus a domain-general explanation of the P600.

What does the stop-making-sense task show how *wh*-scope-marking questions are processed in English?

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This paper investigates processing of *wh*-scope-marking (1a) in English to demonstrate that reaction times (RTs) from a stop-making-sense task (a) confirm earlier reports of increased processing load at a second *wh*-phrase in English native speakers (NSs), (b) show that such questions are *easier* for German second-language learners (L2ers) of English, and (c) help decide among competing analyses of *wh*-scope-marking.

The present study uses a 2×2 factorial design, independently manipulating (i) the presence/absence of a *wh*-phrase in (ii) main/embedded clauses, yielding the conditions shown in (1) with the two factors Extraction (i.e., LD/SM versus IQ/TC) and Complementizer Type (i.e., SM/IQ versus LD/TC). Twenty-eight high-advanced German-English L2ers and 28 English NSs read 24 test items, distributed across 4 lists using a Latin Square design and interspersed with 49 fillers, in a self-paced stop-making-sense task, recording both the number of stop-decisions and the RT for each word.

The overall acceptance rate of the SM (NSs, 15%; L2ers, 79%) suggests that the L2ers are unable to detect the ungrammaticality of SM in on-line processing. The RT data further supports this conclusion. Data from the 13 NSs who did not reject SM immediately in three or more of the six cases show main effects of extraction and complementizer-type. This plausibly reflects increased difficulty (a) in reading a *wh*-phrase vs. a complementizer and (b) when storing a dislocated *wh*-filler while encountering the beginning of an embedded clause. Thus, the SM condition containing a *wh*-phrase in both the main and the embedded clause is most difficult to process, which confirms ERP findings by Kluender & Kutas (1993) on similar sentences. However, the cost of encountering a *wh*-phrase in the embedded clause was much greater in the +Extraction conditions than in the –Extraction conditions, as reflected in a marginally significant interaction, which suggests that this delay is not (solely) due to difficulties in processing a *wh*-phrase but (also) due to the parser detecting a syntactic anomaly. In contrast, no such delay was found for the L2ers in this region, the Germans exhibiting an almost identical processing profile for SM and LD. These on-line data conform with previous findings showing that German L2ers overwhelmingly accept SM in off-line acceptability judgments (Schulz, 2006), corroborating that SM is a genuine phenomenon in English interlanguages.

However, the RT data can also help shed light on the syntactic analysis of SM. The identical processing pattern of SM and LD exhibited by the L2ers suggests that the syntactic structure of SM might be quite similar to the structure of LD, as has been proposed by direct-dependency approaches (e.g., McDaniel 1989) in which the two *wh*-phrases are associated with one base-position in the embedded clause. In contrast, indirect-dependency approaches (e.g., Dayal 1994) associate the two *wh*-phrases with two different gaps, one in the main and one in the embedded clause, resulting in a syntactic structure quite different from that of LD. Thus, the shared processing pattern between the two constructions would have to be coincidental under such an analysis.

Examples

(1) a. What did Dan suggest *what he* could do to enhance his career? *wh*- Scope Marking, SM
   b. What did Dan suggest *that he* could do to enhance his career? Long-Distance Movement, LD
   c. Dan suggested *what he* could do to enhance his career. Indirect Question, IQ
   d. Dan suggested *that he* could do a lot more work for his company. Embedded *that*-Clause, TC

Table. 1. Reaction Times (on the critical region, combining *that/what* with the following pronoun)

	LD	SM	
Native speakers	−80 ms	+240 ms	F(1,12)=10.5, p<.01
Second language learners	−33.3 ms	−33.8 ms	

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Patterns of prosodic phrasing in disambiguated Hebrew nominals: A Post-to-Times study

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We present new production data on the prosody-syntax interface, derived from two contrasting constructions in Hebrew. They both have two nouns and their compositional meaning is identical, but their syntax and phonology differ. The *free state* (FS) nominal is similar to English, e.g., *the coach of the wrestler*. The *construct state* (CS) nominal lacks the preposition, has stress on the second noun, and the construction constitutes one phonological word despite its internal syntactic structure (Borer, 1988). When followed by a relative clause (RC), the two constructions (see (1a,b)) are syntactically/semantically ambiguous in the same way; but they contrast prosodically because one phrasing pattern permitted for FS is inhibited for CS by the phonological word constraint.

Method: Sentences were presented visually. They were contextually disambiguated for high versus low RC-attachment, using the 'Post-to-Times' elicitation protocol (Bradley et al., 2003). Participants (24 Hebrew native speakers) combined unambiguous phrases into a complex sentence containing an RC; see illustration in (2). An initial sentence determined construction type (CS or FS); a following question determined RC-attachment (high or low); the answer to it determined RC-length (short=1, long=3 phonological words). Prosodic boundaries were established by a ToBI-like coding supported by acoustic analyses.

Results (see data in (3)):

- *Attachment height*: Prosodic phrasing varied greatly as a function of forced high/low RC-attachment. E.g., an FS with short RC exhibited 92.8% breaks at [RC for high attachment, but only 32.3% for low attachment. (Mean high = 96.7%; mean low = 64.2%.) This is in accord with production data for Croatian (Lovrić, 2003) and German (Augurzky et al., 2005), and it complements perception data for English (Maynell, 1999). It is predicted by Selkirk's (2000) Align$_R$ XP constraint which would insert a break at the]DP]PP brackets that precede a high-attaching RC.

- The fact that identical word-strings, disambiguated for attachment height only by the preamble question, showed strongly contrasting prosody provides clear validation for the Post-to-Times protocol, which has not previously been used with high attachment.

- *Construction type*: FS and CS prosody differed for low attachment, e.g., 40.6% [N2 breaks for short-RC FS but only 7.4% for short-RC CS. This difference can be ascribed to the phonological word constraint on CS, which disfavors a break between the two nouns. For high attachment, FS and CS prosody was highly similar (regardless of RC-length), with almost all breaks before RC as noted above. This indicates that syntactic alignment outranks other constraints in Hebrew.

- *RC length*: As has been found in other languages, there was an effect of RC-length. More prosodic breaks occurred at [RC for long RC than for short, in line with the hypothesis that a pre-RC break is often the default phrasing for long RC (Fodor, 2002). However, in Hebrew this occurs only with low attachment. For high attachment, [RC breaks predominated in all conditions due to the alignment constraint.

- RC-attachment results for silent reading reported in Shaked et al. (2004) can be explained by the ranking of constraints derived from these production data.

(1)   a. Free state: ha-me'amen šel ha-mit'agref še-paraš le'axar ha-taxarut
       b. Construct state: me'amen   ha-mit'agref še-paraš le'axar ha-taxarut
                             (the-)coach of the-wrestler who-retired after the-fight

(2)   Elicitation protocol (example shown in English here = FS with short RC disambiguated for high attachment)
       ♦The-fans admired the-coach of the-wrestler. ♦ Which coach? ♦ The-coach who-retired.
       Target production: The-fans admired the-coach of the-wrestler who-retired.

(3)   *Table 1.* Categorization of elicited utterances (percent) by prosodic break position,
              as a function of attachment height, construction type, and RC length.

		Free State		Construct State	
		Long RC	Short RC	Long RC	Short RC
High	[N1		6.2		5.3
	[N2		1.0		1.1
	[RC	100.0	92.8	100.0	93.7
Low	[N1	1.0	27.1	3.1	47.5
	[N2	15.6	40.6	1.0	7.4
	[RC	83.3	32.3	95.9	45.2

Processing of Scrambling in Russian: the Role of Discourse Context

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Parsing studies of scrambled constructions usually ignore the influential context factor comparing different word orders in isolation. Recently several experiments have been reported where scrambled and canonical word orders were compared in context. The present study makes a step further providing a closer investigation of the discourse context factor.

Our design is similar to one of the experiments on Finnish described in (Kaiser & Trueswell 2004), but more complex Russian constructions were examined, which allowed for a much more fine-grained analysis of the context factor. Finnish and Russian both have syntactically free word order, which is heavily influenced by the discourse status of constituents. In particular, Given almost always precedes New in narrative sentences. So the context presupposing Given-New word order in the experimental sentence was taken as an appropriate one (AC), while the context presupposing New-Given word order as an inappropriate one (IC).

There was an earlier experiment on Russian where the processing of different word orders was studied in context (Sekerina 2003). But both canonical and scrambled word orders were presented in the *same* context, so only the effect of presence vs. absence of the context was examined.

K&T compared Finnish SVO and OVS sentences and concluded that "the usual difficulty associated with noncanonical constructions is partially alleviated" in the ACs (K&T 2004, p.113). In our work, Russian S V IO DO (canonical), DO S V IO and DO IO V S constructions were studied in a self-paced reading task. The experimental sentences contained the same lexical material, but were presented in three different word orders (first factor) and in appropriate and inappropriate contexts (second factor). In ACs, two first NPs were given and the third one was new, while in ICs, the first NP was new and the second and third ones were given (and therefore contextually inappropriate).

In our experiment, a significant difference between the sentences in ACs vs. ICs was found, while there was no difference between different word orders inside these groups. SVO and OVS sentences in (K&T 2004) might have been too short and the context too simple for the context effect to develop fully. Our results might indicate that the additional processing cost associated to scrambled sentences which was found in some previous studies was at least partly caused by their inappropriateness in the zero context.

The innovation of the experiment as compared to previous studies is the fine-grained analysis of the contextual effect. We could localize the slow-down caused by discourse accommodation problems in the IC group. It is not delayed until the final discourse integration at the end of the sentence and starts at the first contextually inappropriate constituent. But, interestingly, the timing of the effect depends on the nature of constituent and its place in the sentence structure. We found an immediate peaking slow-down on preverbal subjects, less pronounced effect on postverbal IOs and more prolonged slowly increasing slow-down on preverbal IOs. We will propose an explanation deriving these differences from their syntactic nature.

Examples

DO IO V S sentence in the appropriate context (AC):

Na Novyj god	Masha Smolina	poluchila	pljushevogo slona	i	korobku konfet.
For New Year	[Masha Smolina](NOM)	got	[stuffed elephant](ACC)	and	[box of candies](ACC)

Korobku konfet	Mashe Smolinoj	podaril	Petya Ivanov.
[box of chocolates](ACC)	[Masha Smolina](DAT)	gave	[Petya Ivanov](NOM)

DO IO V S sentence in the inappropriate context (IC):

Petya Ivanov	pozdravil	Mashu Smolinu	s Novym godom.
[Petya Ivanov](NOM)	congratulated	[Masha Smolina](ACC)	with New Year.

Korobku konfet	Mashe Smolinoj	podaril	Petya Ivanov.
[box of chocolates](ACC)	[Masha Smolina](DAT)	gave	[Petya Ivanov](NOM)

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Information-structural constraints on word order in processing English

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Many languages permit considerable flexibility of word order. However, when a phrase appears in a non-canonical position, typically there are information-structure constraints on its discourse status. For example, in Finnish, canonical order is SVO. When listeners encounter an OV sentence-initially, they predict that the (post-verbal) subject will refer to some discourse-new entity (Kaiser and Trueswell, 2004). In a language like German, a phrase may be scrambled to a position earlier than its canonical position. But typically the scrambled phrase must be already given in discourse and the remainder of the clause will receive narrow focus (Bader and Meng, 1999).

In a language with scrambling, identifying the structural position of arguments may be difficult. However, when the sentence contains an adverb, the adverb can identify a structural position that allows the position of the argument to be determined. In German, for example, it has been argued that the subject may be scrambled in front of a speaker-oriented adverb, but only if the subject can serve as a topic (Frey, 2000; Meinunger, 1995). In short, in scrambling languages, adverb position may help to identify structural position, which in turn indirectly conveys information-structure constraints.

The question to be addressed here is what happens in a fixed word order language like English? Do adverbs convey information-structure constraints? It has been assumed that English, in contrast to languages like German, does not contain a position for topics, but has only one subject position (see Bobaljik & Jonas, 1996; Svenonius, 2002). If, contrary to this assumption, adverb placement in English is comparable to adverb placement in German with respect to conveying information-structure constraints, then in an English sentence in which the subject precedes a speaker-oriented adverb, topical properties might be attributed to the subject. Sentences like the examples in (1) were used in a self-paced reading study to test the hypothesis that adverb position conveys information-structure constraints. Both (1a) and (1c) should be read easily, since the syntactic position following the speaker-oriented adverb *presumably* has no information-structural restrictions.. In addition, (1b) should be read easily, because the referential NP *the king* can occur as a possible topic before the adverb. However, the subject of (1c) and (1d), *no king,* is non-referential and thus cannot serve as a topic. If the adverb order of (1d) indicates that the subject is a topic, then (1d) should be read slowly.

The self-paced reading study revealed significantly longer reading times for the complement clause for sentences with a non-referential subject preceding the adverb like (1d) in comparison to the other conditions. The data suggest that even in a fixed word order language like English adverb placement can influence assumptions about topichood in a manner similar to that proposed for scrambling languages.

		(reading times, ms)
(1)	a. The envoy said that presumably the king defeated the knights.	(2208)
	b. The envoy said that the king presumably defeated the knights.	(2178)
	c. The envoy said that presumably no king defeated the knights.	(2277)
	d. The envoy said that no king presumably defeated the knights.	(2555)

Prosodic disambiguation of relative clauses in sentence production in Spanish

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We report a sentence production study intended to track possible patterns of prosodic disambiguation of ambiguous relative clauses (RCs) in Spanish with two potential attachment sites. We used an elicitation paradigm, embedded in a simulated dialog between the participant and a virtual conversation partner, so as to have participants produce syntactically ambiguous sentences that could be disambiguated through their prosodic structure, and their unambiguous counterparts. On each trial, subjects were given a short context followed by a sentence, a question and an answer to that question, and were instructed to reply with another utterance by combining parts of the previous sentences.

Contexts were manipulated in such a way that the resulting sentences could either have a restrictive or a non-restrictive reading of the RC. In addition, each sentence had two versions, one containing a long RC, and the other, a short RC. Finally, the question specified which of the two antecedent nouns was intended as attachment site for the RC, thus yielding a high attachment or a low attachment version for each sentence. Both antecedent nouns were matched in length (in syllables), and stress placement, and all RCs (long and short) were also matched in number of syllables. Examples of ambiguous and unambiguous sentences, with long and short RCs, are shown below.

Five female participants volunteered for the experiment. The prosodic analyses performed were focussed on the following measures: duration of pauses at major prosodic boundaries, duration of both antecedent nouns, difference between the duration of the second antecedent noun and the break following it (located at the RC boundary), and a number of intonational measures, such as intonation contour of the sentence, difference between f0 peaks in both nouns and initial and final f0 values, and the difference between the f0 peak at the second noun and at the onset of the RC.

The results may be summarized as follows: (1) participants made longer pauses at the boundary between the matrix clause and the RC in sentences with non-restrictive RCs, with long RCs, and to a lesser extent, with high attached RCs; (2) the second noun was longer in sentences with non-restrictive RCs, with long RCs and with high attached RCs; (3) pauses at the boundary before the RC were relatively longer, when compared to the duration of the preceding noun, in sentences with restrictive RCs, with longer RCs, and with low attached RCs; and (4) a sharper decline in f0 contour from the second noun to the RC onset was found in sentences with restrictive RCs, and in sentences with long and high attached RCs. Overall, a clearer pattern of differences in prosodic structure as a function of RC length and attachment type emerged for sentences with restrictive than with non-restrictive RCs. Moreover, RC length appears to be more important than attachment type for the control of prosodic structure in sentence production. Finally, and most importantly, differences in prosodic patterns between ambiguous and unambiguous sentences were negligible, which suggests that prosody plays no special role in sentence disambiguation.

Ambiguous sentences: Ellos vieron al hermano del maestro que [fue urgentemente operado] / [se callo']
       They saw the brother of the teacher who [was urgently operated] / [was silent]

Unambiguous sentences:

    High attachment: Ellos vieron al hermano de los maestros que [fue urgentemente operado] / [se callo']
       They saw the brother of the teachers who [was urgently operated] / [was silent]

    Low attachment: Ellos vieron a los hermanos del maestro que [fue urgentemente operado] / [se callo']
       They saw the brothers of the teacher who [was urgently operated] / [was silent]

Contextual expectations in modification ambiguities

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Modification ambiguities have served as test cases for theories of sentence processing, e.g., VP/NP modification ambiguities like "the spy saw the cop with…" in which the temporarily ambiguous PP could either modify the verb "saw" (e.g., "…with binoculars") or the NP "the cop" (e.g., "…with a revolver"). Early findings of a strong VP modification preference were taken to support the hypothesis that initial interpretation is affected only by syntax. Later, Referential Theory explained those findings in terms of presuppositional complexity, citing one of the primary functions of NP modification as unique reference. Experiments with multiple referents in the context moderated the VP preference, presumably because NP modification was then felicitous in identifying a unique referent among the different possibilities. The referential account is attractive because it explains why we have modification in the first place, but it only applies to NP modification, leaving open the question of why we have VP modification at all.

Verbs have different senses, so the interpretation of the event in "the lawyer hit the plaintiff with…" differs greatly depending on the content of the PP (e.g., "…a lawsuit" versus "…a brick"). Part of the VP modification preference might stem from the need to specify the nature of the event being more fundamental than the need to identify a unique referent. This can be seen as an extension of Referential Theory, in that in a very loose sense it's more important to identify the unique referent of the verb (that referent being the nature of the event) than a participant (the NP) in the event. To date, experiments have only manipulated the potential set of NP referents in the context, but the current experiment also manipulates the contextual expectation for VP modification as well:

(1)   VP modification bias: The handyman wasn't sure which tool to use first, so he fixed the television with…

(2)   NP modification bias: The handyman wasn't sure which television to work on first, so he fixed the television with…

In (1), the context sets up a contrast set of possible instruments to be used in the event and the ambiguous PP "with…" is needed to modify the verb to specify which instrument. In (2), the context sets up a contrast set of possible televisions, so the PP is needed for NP modification to pick out a specific referent. The PPs were manipulated to force the disambiguation (e.g., "with a soldering iron" for VP modification and "with a broken screen" for NP modification). These items were presented using a single-word, self-paced reading task. A significant interaction of both variables was found at the word following the disambiguation (standard error in parentheses):

	VP Disamb.	NP Disamb.
VP Bias	374ms (14ms)	475ms (29ms)
NP Bias	420ms (22ms)	429ms (18ms)

In VP bias contexts, VP modification was strongly preferred, whereas when the context biased NP modification, no preference in disambiguation was found. Interestingly, this experiment was also run with older adults (age 65-75). They showed the same pattern in the VP expectation conditions, but showed a significant preference for NP disambiguation in the NP expectation conditions, a significant difference from the young adults, consistent with the hypothesis that older adults more strongly on semantic constraints. The discussion will focus on the theoretical impact of these data, with particular attention to what implications the aging data have on how context constrains processing.

Sentential focus affects visual attention toward potential verb arguments

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Previous eye tracking research using sentences like (1) suggested that a dative verb introduces an indirect object (recipient) into the discourse (Boland, 2005). Boland found anticipatory fixations on photographs depicting potential recipients following dative (but not transitive) verbs. Datives also require a direct object (theme), but there were relatively few fixations on photographs depicting themes, even after the pronoun. In the current study, the theme attracts a high proportion of fixations when it is prominent (i.e., focused, Selkirk, 1984) in a sentence's information structure.

In fifteen sets of items we manipulated sentence structure such that, at the verb, the theme was either still in focus (2) or not (3), using the same dative (e.g., loan) and transitive control (e.g., own) verbs in both conditions. We also manipulated the frequency with which the dative verbs occurred with recipient arguments. Twenty-one participants listened to the sentences while looking at photos corresponding to the agent, theme, and potential recipient of the critical verb. A fourth photo depicted an object that was not a potential argument of either the dative or the control verb.

We examined gaze in 100 ms bins 200-1000 ms after the onset of dative and transitive verbs. Fixations on the theme were much more likely in the focused condition. This effect interacted with both verb-type and temporal bin, with the verb-type by focus interaction localized 600-1000 ms after verb onset. For the high frequency datives, fixations on the theme in the focused condition declined 600-1000 ms after verb onset as attention shifted toward other depicted entities.

Fixations on the recipient were also influenced by the focus manipulation, though less dramatically. When the theme was focused, the critical verb was in a relative clause. When the theme was unfocused, the verb was in a more prominent position, as in Boland (2005). The current research investigated whether the anticipatory fixations on recipients found in Boland (2005) would be replicated if the verb were in a less prominent position. In fact, sentence structure interacted with both temporal bin and verb-type. High frequency datives prompted more fixations on recipients across the entire critical interval when the verb was in a main clause. Surprisingly, the control condition also had more fixations on recipients when the verb was in a main clause, but this effect interacted with temporal bin, beginning substantially later than for datives.

This research demonstrates that sentential focus strongly influences visual attention toward event participants, at times minimizing effects of argument structure. In a related experiment, using nearly identical materials in an auditory change-detection paradigm, listeners were less sensitive to dative/transitive verb substitutions when the theme was focused. Taken together, these findings suggest that verb meaning (or perhaps argument structure) is processed more deeply when a verb is in a more prominent position.

Examples.

(1) The house was dirty inside, but the realtor swept/sold it easily for/to some newlyweds.

(2) The necklace that the well-known jeweler loaned/owned/sold was worth a million dollars.

(3) Because one comic book was extremely rare, the famous collector loaned/owned/sold it in secret.

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Encoding and Retrieving Syntactic Structure with Prosodic Phrasing

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ABSTRACT UNAVAILABLE

The influence of memory load on heuristic interpretation processes

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Recent research by Ferreira and colleagues has suggested that there is a systematic tendency to misinterpret syntactically unambiguous sentences when the correct interpretation conflicts with world knowledge. In a rating study, examining sentences like 1 below, readers rated passive implausible sentences (1d) as plausible approximately 25% of the time [A]. Moreover, in [B], listeners answered incorrectly 24% of the time when asked to identify the agent of the sentence in a thematic role judgement task [C]. The results were discussed in terms of heuristic, non-syntactic interpretation processes, in this case the tendency to assign an Agent-Verb-Theme interpretation to a Noun-Verb-Noun sequence. However, these judgment data do not tell us how, or whether, the heuristics interacted with syntax during online processing.

Three experiments attempted to replicate these findings and to investigate the time-course of the developing interpretation. Experiment 1 was an off-line questionnaire study in which participants read sentences like (1), given below in its four conditions. In contrast to Ferreira and Stacey's results, plausibility ratings indicated high levels of correct interpretation across conditions; the two implausible conditions both received statistically equivalent low ratings, and the two plausible conditions both received statistically equivalent high ratings.

Experiment 2 used word-by-word self-paced reading with 24 materials selected from Experiment 1. After each trial, participants had to identify the agent or patient of the sentence [C]. Since correct syntactic processing should result in plausibility differences at the second NP, we measured reading times on the head noun (i.e. "child" in 1d, below), to check for early, grammatical processing, and the three following words, to allow for spillover. Accuracy of role judgements was reliably higher for plausible than the implausible sentences. The difference was numerically greater for the passives (72% vs. 90%) than for the actives (82% vs. 91%), though the two factors did not interact. In the reading times, there was a main effect of plausibility, with a slowdown for the implausible conditions 2 and 3 words downstream of the critical word, which was statistically equivalent for both actives and passives.

Experiment 3 increased syntactic load by embedding the same 24 materials in a more complex sentence frame [D]. This time, there was a reliable interaction in the judgment data, with a greater disadvantage for the implausible conditions in the passives (59% vs. 83%) than the actives (67% vs. 80%). As in Experiment 2, there was an RT effect of plausibility 3 words downstream of the critical word, again not interacting with the active/passive manipulation.

Our results suggest a role of memory load in the use of heuristics. In our Experiment 1, participants were free to re-read the sentence while rating plausibility, and their judgments were clearly based on syntax. The self-paced reading experiments precluded such re-reading, thus increasing memory load, and there was reliable evidence of misinterpretation when memory resources were further strained with a syntactic manipulation (Experiment 3; see also [E]). Additionally, the reading time data suggest that syntax influences the developing interpretation during on-line processing, even under conditions of high load.

Example: (1) a) *Active Plausible*   The soldier protected the child during the battle
           b) *Active Implausible*   The child protected the soldier during the battle
           c) *Passive Plausible*   The child was protected by the soldier during the battle
           d) *Passive Implausible* The soldier was protected by the child during the battle

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Licensor strength and locality effects in negative polarity licensing

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In sentence comprehension, dependencies must be established between linguistic elements in real time. Two robust determinants of dependency resolution are locality (Gibson 1998; Lewis 1996) and interference (VanDyke and Lewis 2003; Gordon, Hendrick, & Johnson 2001).

Negative Polarity Items (NPIs) require a different dependency satisfaction from filler-gap or argument-head dependencies. NPIs must be licensed, for example by c-commanding negation, but can have licensors of differing strength. Previous work by Vasishth, Drenhaus, Saddy, and Lewis (2005) suggests that (a) when an NPI attempts to retrieve a licensor, cue mismatches or outright failures disrupt processing, and (b) a licensor in an illegal syntactic position causes accidental retrievals, resulting in an illusion of grammaticality.

These properties of NPI dependencies raise the following questions: (i) does locality impact NPI dependencies?; (ii) does the strength of a licensor or the ease of determining whether an NPI is within a licensing domain affect the difficulty of establishing an NPI dependency?

Two self-paced reading studies, in English and German, addressed these questions. The design of both was 3 x 2, crossing licensor strength (strong, moderate, none) with licensor-NPI distance (short vs. long). The NPI "ever" appeared inside a RC, whose head's determiner determined licensor strength.

The determiner "no" was considered a strong licenser because: (i) it contains the anti-morphic negation operator and (ii) it licenses broadly within a c-command relationship. "Every" was considered a moderate licensor because: (i) it's anti-additive and (ii) licenses under more narrow circumstances, i.e. only within its restrictor. "The" provided no licensor for the NPI. Licensing distance was varied by the insertion of a subject and sentential complement-taking verb prior to the NPI.

A distance effect was predicted (Gibson 2000, Lewis and Vasishth 2005). Weaker licensors should cause slower processing at the NPI.

In English (n=60), there was a distance effect (long > short) at the NPI and two following words. The subject gap may contribute to this effect, but the effect's persistence is unusual for a gap effect. German (n=55) showed a reverse distance effect (short > long) at both the NPI and the following word. This is consistent with previous findings in English and German (Grodner and Gibson 2005; Konieczny 2000).

In English, licensing had no effect at the NPI, but processing was slowed on the following word in conditions without licensors. The strong and moderate licensor conditions did not differ. In German, at the NPI in only the short conditions, the strong licensor conditions were read faster than the moderate licensor conditions. No other licensing effects were reliable on the NPI, but processing was slowed on the following word for conditions without licensors.

These results suggest that:

1. The polarity distance effects reflect the English-German asymmetry found with other kinds of dependencies. However, the German anti-locality effect for NPIs calls into question accounts explaining anti-locality effects based on strong predictions for a dependency.

2. The faster retrieval of the stronger licensor in German indicates that lexical specifications of NPIs may be sensitive to logical properties of the licensor.

Strong licensor, short (long)
(1a) No man who (the woman said) ever ate Chinese food liked playing football.

Moderate licensor, short (long)
(1c) Every man who (the woman said) ever ate Chinese food liked playing football.

No licensor, short (long)
(1e) The man who (the woman said) ever ate Chinese food liked playing football.

Information structure and the anticipation of referents: Effects of word order and intonation

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Different languages use different means -- including articles, word order and intonation -- to encode the distinction between GIVEN and NEW information. Kaiser & Trueswell (2004) investigated one of these information-structural options, word order, and found that in Finnish, noncanonical OVS sentences trigger the anticipation that the referent of the upcoming postverbal noun will be NEW rather than GIVEN.

We investigate whether an arguably more subtle type of information-structural marking, namely intonation, also triggers anticipatory effects. Intonation differs from word order insofar as the propositional meaning of a sentence can be understood even if intonation is ignored, whereas ignoring overt marking of word order (case-marking on the determiner) can cause misinterpretations, especially with noncanonical orders. To determine whether this difference has implications for processing, we examine whether K&T's word order findings replicate for German (Exp.1), and whether intonation, which in German has been claimed to provide cues to discourse-status, triggers comparable anticipatory effects (Exp.2).

In both experiments, while listening to auditory stimuli (ex.1,2), participants saw scenes depicting three referents, e.g., doctor, nurse, patient. Two referents were mentioned prior to the target sentence (i.e., GIVEN). The third was discourse-NEW. We tracked the time-course of participants' attention to referents in the scenes.

Exp.1-Word order (SVO/OVS). We followed K&T in hypothesizing that, if OVS in German serves to signal the discourse-newness of the postverbal referent, OVS sentences (ex.1b) will trigger more anticipatory fixations to NEW referents than canonical SVO sentences (ex.1a). Crucially, this is predicted to happen before the postverbal referent is mentioned.

Exp.2-Intonation. We tested SVO sentences with two intonational patterns (ex.2a-b). We predicted that an early falling tone (ex.2a) will trigger anticipatory fixations on GIVEN referents, because in German, after a falling tone only GIVEN material can occur postverbally. However, an early rising tone (ex.2b) should trigger anticipatory fixations on NEW referents. In these kinds of sentences in German, a second accent, with a falling pattern, is expected later in the sentence. All sentences were declaratives, which in German have a global falling contour.

We also manipulated the discourse-status (GIVEN/NEW) of postverbal referents in both experiments. We predicted that if there is a mismatch between the discourse-status of the mentioned referent and that predicted by intonation/word order, participants would have to reallocate attention, which would delay fixations to the mentioned referent.

The predictions were borne out. We found an early effect of word order in Exp.1, and an early effect of intonation in Exp.2. OVS word order (ex.1b) triggered the expectation that the upcoming referent is new, as did the intonation contour with the late fall (ex.2b). The magnitudes of the effects were strikingly similar in the two experiments. Effects of mismatching cues appeared at a later point in time. These results are supported by spoken sentence-completion experiments that we have conducted.

Taken together, our results suggest that two different means of information-structural marking -- word order and intonation -- have remarkably similar effects on the time course of the expectations that listeners build up concerning the discourse-status of upcoming referents.

SAMPLE CONTEXT
An der Empfangstheke eines Krankenhauses lehnen ein Arzt und eine Krankenschwester.
A doctor and a nurse are leaning on the reception desk of the hospital.
Die Uhr zeigt fast zwei. // It's almost two o'clock.

(1) TARGET SENTENCE, Exp. 1:
(a) SVO: Der Arzt befragt gleich die Krankenschwester (GIVEN)/die Patientin (NEW).
The-NOM doctor will soon question the nurse/the patient.
(b) OVS: Den Arzt befragt gleich die Krankenschwester (GIVEN)/die Patientin (NEW).
The-ACC doctor will soon question the nurse/the patient.

(2) TARGET SENTENCE, Exp. 2:
(a) early fall: Der Arzt be\FRAGT gleich die Krankenschwester (GIVEN)/die Patientin (NEW).
(b) late fall: Der Arzt befragt gleich die \KRANkenschwester (GIVEN)/die Pa\TIENtin (NEW).

CHILDREN use emphasis TOO: The use of acoustic prominence in four year olds

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There has been a great deal of interest in how adults use accents in language production and comprehension (Shattuck-Hufnagel & Turk, 1996; Cutler, Dahan & Donseallar, 1997). However, with a few exceptions (e.g. Snow & Balog, 2002), very little is known about how these abilities develop in children. These questions are potentially very interesting since appropriate accent use requires an ability to represent complex discourse differences and, more controversially, to take into account the perspective of the listener.

One of the factors that influences accent placement in adult speech is the accessibility of information in the discourse: information that changes in accessibility is more likely to receive an accent than information that does not (Dahan, Tanenhaus & Magnuson, 2002, Watson, Arnold & Tanenhaus, 2005). The current work explores these effects in a production experiment with four year olds.

We considered three hypotheses: 1) children do not adjust prominence to fit discourse contexts; 2) children adjust prominence to indicate gross discourse distinctions, for example accenting given but not new information and 3) children, like adults, use prominence with information that shifts in accessibility.

Sixteen children participated in nine trials. Participants were required to produce pairs of SVO sentences in which the first sentence established a discourse context, while the subject (agent) of the second sentence was the target word later analyzed for acoustic prominence. In order to elicit the sentences, we showed children short video scenes displaying pairs of hand puppets performing simple transitive actions. Each trial consisted of the child viewing two scenes one after the other. After the first, they were asked "What happened?", and after the second, "And then what happened?". There were three trial types, the conditions are below in (1). Only trials in which participants gave free responses were included in the analysis (82% of the data). The crucial manipulation is the change in accessibility in the target word. Subjects, and particularly agents, tend to be highly accessible referents in a discourse (Grosz & Sidner, 1986). Thus in the Given-NonShift condition the target word 'lion' is highly accessible in both the first and second sentences, while in the Given-Shift condition the target word shifts from a position of low accessibility (theme), to a position of high accessibility (agent). Finally, in the New condition the target word has not been mentioned before, so it also shifts to a position of high accessibility.

The results were consistent with hypothesis 3. Acoustic prominence, as measured by average pitch and intensity on the target word, was very similar in the Given-Shift and New conditions. Critically, the Given-Shift condition had significantly higher pitch $F(1,15)=7.99$, $p < .05$, and intensity $F(1,15)=7.40$, $p < .05$, than the Given-NonShift condition.

This work demonstrates that by the age of four, children's usage of acoustic prominence is similar to that of adults, suggesting that children may have the requisite discourse representations for appropriate accent use. In future studies, we hope to explore these effects in even younger children.

(1)   a. Given – NonShift, e.g.
           Sentence 1: The lion hit the giraffe.
           Sentence 2. The lion hit the elephant.

           b. Given – Shift, e.g.
           Sentence 1: The giraffe hit the lion
           Sentence 2: The lion hit the elephant.

           c. New, e.g.
           Sentence 1: The elephant hit the giraffe.
           Sentence 2: The lion hit the elephant.