Prosodic Focus Strengthens Semantic Persistence

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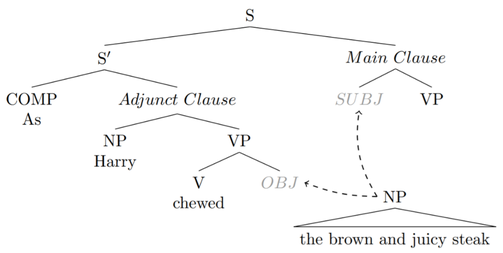
Misinterpretations of Garden-Path Sentences

Previous research on **post-repair representations** of **garden-path sentences** has found that readers arrive at misinterpretations despite evidence of reanalysis [1].

As Harry chewed the brown and juicy steak fell to the floor.



- Q: Did Harry chew the steak? (**Yes**/No)

At the same time, comprehenders are accurate when asked about material *outside* the region of ambiguity.

- Q: Did the steak fall to the floor? (**Yes**/No)

Suggests that comprehenders are not failing to make *any* sense out of these sentences entirely - misinterpretations seem to be patterened and systematic.

The Locus of Misinterpretations

Some proposed explanations:

1. ***The initial semantic commitments*** made in the garden path can persist in working memory without undergoing necessary revisions [2].
2. ***The incorrect local structure*** can linger in the syntactic representation blended/copied alongside the correct structure, licensing the misinterpretation [3].
3. ***Surface-level heuristics*** can be adopted as a compensatory "good enough" strategy when syntactic reanalysis becomes too costly [4].

More recent studies find evidence that the parser actually always succeeds in recovering the globally correct structure in reanalysis [5][6] - likely that the misinterpreation stems from the **persistence of the initial misanalysis in memory** as opposed to failures related to the syntactic structure-building process

Research Question

Is the likelihood of misinterpretation affected by the *depth of semantic processing* in the initial misparse?

In an **auditory comprehension experiment**, we draw on *two known effects of pitch accent on semantic processing*:

1. In American English, a high-rising pitch accent is often associated with semantic focus, and facilitates encoding and retrieval of referent [7].
2. This interpretation of focus is sensitive to the **position of the accented word** in the prosodic phrase [8].

Ex.: Anna dressed the BABY.
- *Anna dressed the BABY.* (default accent)
- *Anna dressed the* $[_N$ *BABY*$]_F$. (contrastive focus)

In garden-path sentences, this accent-to-focus relationship can facilitate an **asymmetrical interpretation of focus** over the region of ambiguity between alternative parses:

While Anna **DRESSED** the baby stopped crying.

- *While Anna DRESSED, the baby …*
  (default accent, early closure)
- *While Anna* $[_V$ *DRESSED*$]_F$ *the baby, …*
  (contrastive accent, late closure)

But no such asymmetry when the subject is accented:

While **ANNA** dressed the baby stopped crying.

- *While* $[_{NP}$ *ANNA*$]_F$ *dressed, the baby …*
  (contrastive accent, early closure)
- *While* $[_{NP}$ *ANNA*$]_F$ *dressed the baby, …*
  (contrastive accent, late closure)

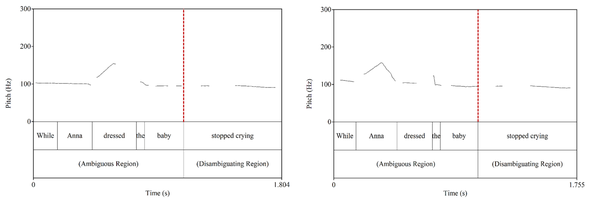
We predict **lower accuracy** on comprehension questions in the **verb-accent condition**, where the intitial misanalysis in the late-closure parse is *enriched* with focus-semantic meaning that later *requires revision*.

Q: Was the baby dressed? (Yes/No)

Materials

Twenty-four garden-path sentences were recorded in subject/verb-accent conditions and **resynthesized** to make prosodic phrase boundary cues uninformative (to induce the garden-path effect):

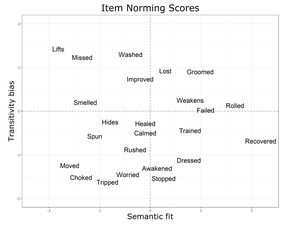
1. A trained male speaker produced the early- and late-closure variants of each sentence: *While Anna dressed the baby (∅/he) slept*.
2. The durations of pre-boundary candidates (1st verb, 2nd noun) were resynthesized to the average of the two variants, with early-closure recordings as the source.
3. Disambiguating region was spliced from the subject-accent recordings into the verb-accent recordings and the f0 contour was interpolated across the clause boundary and flattened over the main clause.



Resynthesized Measures

	First Noun		*First Verb*		*Second Noun*	
Condition	Duration	Max f0	Duration	Max f0	Duration	Max f0
Subject	296 (42)	155 (9)	309 (63)	119 (14)	308 (83)	96 (8)
Verb	242 (27)	109 (8)	362 (67)	150 (10)	308 (80)	102 (8)

4. Sentences were **normed** for *transitivity bias* (of the adjunct verb) and *semantic fit* (of the 2nd NP as the embedded object) to control for local coherence effects.

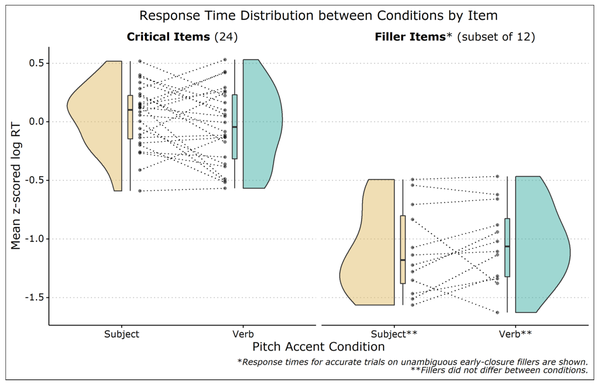


Procedure

60 online participants listened to 24 garden-path sentences with varing pitch accent location and answered a yes/no comprehension question in a 5 second window.

Results

	Accuracy		**Response Time**	
	β **(*se*)**	***p***	β **(*se*)**	***p***
Pitch (Verb)	-0.19 (.08)	**0.044**	-0.009 (.008)	0.289
Semantic Fit	-0.44 (.15)	**0.006**	0.031 (.014)	**0.034**
Transitivity	-0.19 (.16)	0.238	0.035 (.015)	**0.022**
Accuracy			0.065 (.021)	**<0.001**



Discussion

Evidence for **semantic nature** of the persistence effect:

1. **Longer response times in the critical trials** compared to unambiguous fillers indicate that listeners were garden-pathed in both conditions as intended.
2. **Negative effect of (verb) pitch accent on accuracy** suggests that the processing of focus semantic meaning in the garden path increased the persistence of the erroneous interpretation.
3. **No response time differences between conditions** suggests that (focus) semantic processing is not necessarily tied to syntactic structure-building.
4. This effect of pitch accenting on semantic persistence is significant **after controlling for local coherence effects** (transitivity bias and semantic fit).

Additional implications:

- Prosody in psycholinguistics: "semantic processing" as discussed in prosody and sentence processing research may be more closely linked than previously thought.
- Parallel vs. Serial: transitivity as a non-significant predictor of accuracy might point to an *incremental semantic processor* acting independently in reanalysis.

Acknowledgments:

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