

## How might a rapid serial visual presentation of text affect the prosody projected implicitly during silent reading?

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Prosody exerts a force on the process of computing the syntactic structure of a string of words, not only when it is available as part of the signal (Carlson, Clifton & Frazier, 2001, among others), but also when it is only projected mentally during silent reading (Fodor, 2002). I will discuss how the visual presentation of text might affect the prosodic structure projected during silent reading, by examining evidence on how differently timed visual presentations modulate the interpretation of ambiguous relative clauses (RCs). I will argue that such effects are best understood as linked to prosody, and I will identify properties of the data which help rule out alternative explanations.

The experimental series focuses on how globally ambiguous strings like (1a) and (1b) are interpreted by native speakers of American English.

- (1) a. The judge telephoned the trainer of the gymnast who was sick.  
b. The judge telephone the trainer of the gymnast who was sick during the opening ceremonies.  
c. Who was sick?  
the trainer                      the gymnast

In such sentences, the RC *who was sick* can permissibly refer to either *trainer* (N1) or *gymnast* (N2). In all experiments, target materials contained either short (1a) or long (1b) RCs. Interpretation was measured systematically by asking participants questions like (1c) for both short and long versions of the sentence, in a forced-choice task presented as a test of reading comprehension. For all experiments, participant- and item-based mean percent N1 responses (“N1 attachment rates”) were used in the analyses. Target materials were interspersed among distractors representing a variety of constructions, and for which the question had only one correct answer.

Experiment 1 emulated standard questionnaire tasks. Sentences appeared on a single line centered on a computer screen and were followed—upon the participant's request—by the comprehension question plus its two potential answers. N1 attachment rates were modulated by the length of the RC: 53.1% for short, 58.4% for long.

Experiment 2 employed a rapid serial visual presentation (RSVP) technique: sentences appeared word-by-word, at an invariant rate of 500 ms per word. In Experiment 2, no length effect was observed, and N1 attachment rates decreased reliably: 43.9% for short, 44.4% for long.

The length effect observed in Experiment 1 is most parsimoniously interpreted as linked to prosody. During close to normal silent reading conditions, the prosodic structure projected may include a phrasal break before the RC, a break that is more likely, on prosodic grounds, before a long than a short RC (Bradley, Fernández & Taylor, 2003). Such a break encourages interpretation of the RC as referring to N1 (Fodor, 2002). In contrast, the invariant rate of the RSVP presentation used Experiment 2 likely disrupts the projection of implicit prosody, as in articulatory suppression tasks (Slowiaczek & Clifton, 1980); if a prosodic structure cannot be built, interpretation of the RC will be dictated by the parser's built-in preference to attach locally, to N2.

The combined findings of Experiments 1 and 2 are difficult to reconcile with models that invoke information structure as driving length effects on attachment preferences (e.g.,

Hemforth & Konieczny, 2002), since the information weight difference between short and long RCs is present in Experiment 2, but the length effect is absent. Models which link variation in interpretation to the lexical properties of the host nouns (e.g., Desmet, De Baecke, Drieghe, Brysbaert & Vonk, 2006) also cannot account for these data: the same lexical material is present in Experiments 1 and 2, yet attachment preferences differ.

Experiments 3 and 4 were designed to further examine the stipulation that the RSVP presentation of Experiment 2 disrupted the projection of a prosodic structure. The presentation was also RSVP, but the word-by-word timing was variable: 225 ms per word plus 20 ms per character. This presentation rate is within the range of eye fixation rates during normal reading, as well as within the range of speeded presentation rates yielding accurate reading comprehension (Juola, Ward & MacNamara, 1982). In both Experiments 3 and 4, the variable presentation rate restored the length effect: Experiment 3, 50.0% short, 54.2% long; Experiment 4, 48.0% short, 51.5% long. Arguably, the variable rate presentation of Experiments 3 and 4 did not disrupt the projection of an implicit prosody as much as the invariant rate of Experiment 2.

Experiment 3 additionally examined materials in which either N1 or N2 remained on the screen three times longer than based on its length in characters, a manipulation simulating increases in duration resulting from producing N1 or N2 with a pitch accent denoting focus (Schafer, Carter, Clifton & Frazier, 1996). Experiment 4 included materials containing a blank screen following N1 or N2, 675 ms in duration (three times the base rate of 225 ms per word), to produce an effect of phrasal breaks that either encourage interpretations of the RC as referring to N1 (phrasal break after N2) or to N2 (phrasal break after N1).

For materials with short RCs, those additional manipulations affected interpretation of the ambiguous RC. In Experiment 3, increasing the time N2 remained on the screen reliably decreased N1 attachment rates, to 43.1%. Increasing the time N1 remained on the screen also decreased N1 attachment rates, to 44.4%, though this did not differ reliably from the baseline materials in which neither N1 nor N2 remained on the screen longer. In Experiment 4, inserting a blank screen after N1 decreased N1 attachment rates to 45.1%, while inserting a blank screen after N2 increased N1 attachment rates to 52.1%. I will argue that these findings reflect the operation of prosodic phrasing, although working memory limitations need to be considered to explain why these manipulations only affected materials with short RCs.

A final Experiment 5, currently underway, employs stimuli consisting of recorded utterances produced with the phrasing manipulations of Experiment 4: no breaks, one break after N1, one break after N2.

## References

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