



Prosodic and Individual Influences on the Interpretation of *Only*

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Abstract

This study investigates factors that influence the interpretation of ambiguous sentences containing the word *only*. When *only* appears preverbally in simple SVO constructions, it can be interpreted as associating with the direct object, the verb, or the entire verb phrase. An auditory sentence completion task was used to probe native-speaking English listeners for overall biases in the interpretation of *only*, as well as for the influence of accentuation and individual differences on the extent of any such biases. Results show a strong preference for *only* to associate with the direct object overall, although this preference is reduced when the direct object is less (relatively) prominent. Finally, the effect of accentuation was itself modulated by individual differences related to cognitive processing style.

Index Terms: prosody, focus, individual differences, prominence, intonation

1. Introduction

1.1. “Only” and focus

The interpretation of sentences like (1) is determined in part by the association of *only* with a constituent within the verb phrase.

- (1) Stephen *only* dried the bowls.

Here, we adopt the “association with focus” analysis proposed in Rooth’s Alternative Semantics and assume that the associate of “*only*” is F-marked or focused [1, 2]. Under this approach, the interpretation of *only* involves both an assertion of the focused material and a negation of relevant alternatives. For instance, in (1), *only* can associate with the direct object (DO) “*the bowls*”, the entire verb phrase (VP) “*dried the bowls*”, or merely the verb (V) “*dried*”, corresponding to the truth-conditionally distinct interpretations (2), (3), and (4) respectively.

- (2) Stephan dried the [bowls]_{FOCUS} and dried nothing else.
(3) Stephan [dried the bowls]_{FOCUS} and did nothing else.
(4) Stephan [dried]_{FOCUS} the bowls and did nothing else to them.

1.2. Focus and prosody

In English, focus can be signaled by prosodic prominence, specifically the presence of a pitch accent [3], as in (5) and (6), where capitals represent the nuclear (i.e. primary) accent in the sentence.

- (5) Stephan dried the BOWLS.
(6) Stephan DRIED the bowls.

It is unsurprising that the accent placement in (5) and (6) can correspond to the narrow focus interpretations in (2) and (4) respectively. However, according to the Focus Projection Hypothesis (FPH) [4, 5], a nuclear pitch accent on the direct object, as in (5), is also an appropriate realization for (3), in which a broader constituent (the entire VP) is focused. In other words, the FPH predicts that an additional, prenuclear accent on the verb is not needed to mark the verb as part of the focus and is thus unnecessary for a broad VP focus interpretation.

Experimental work on this ambiguity shows mixed results. For example, studies in which listeners must judge “appropriateness” for sentences with different focus structures find no clear preference for the presence versus absence of a prenuclear accent on the verb [6, 7]; however, when listeners are directed to attend to prosody specifically, a very small preference for VP foci to have prenuclear-accented verbs emerges [8]. Production studies [9, 10, 11] and some perception and processing studies that do not depend on ratings of appropriateness judgments [12, 13], however, suggest participants prefer for broader foci (i.e., VP foci) to have prenuclear-accented verbs and for narrower foci (i.e., DO foci) to lack them. There remains controversy over the linguistic (i.e., phonological) status of this preference [14], but it does seem clear that the VP/DO focus contrast in English SVO constructions is not genuinely ambiguous prosodically.

1.3. Individual differences and prosody

Although prosody seems to have some systematic influence on the resolution of focus ambiguities like the one of interest here, the use of prosodic information for interpretive purposes may not be uniform across all English-speaking listeners. Previous literature suggests that individual differences in “cognitive processing style” [15], in particular those related to “autistic traits”, can influence linguistic processing in perceptual and psycholinguistic tasks [16, 17]. Autistic traits, or personality characteristics/ patterns of information processing associated with Autism Spectrum Disorder, can be measured in the general (i.e., neurotypical) population using instruments such as the Autism Spectrum Quotient (the AQ) [18]. One particular subscale of the AQ, measuring communication abilities (arguably most related to pragmatic processing), has been found to predict sensitivity to prosody in recent work. For example, [19] found listeners with higher AQ communication subscale (henceforth AQ-Comm) scores, indicating worse communication abilities, performed differently in a prosodic priming task than listeners with lower scores. They attributed this difference to a reduced sensitivity to accentuation in the higher AQ-Comm participants. Consistent with this, [20] and [13] found that high AQ-Comm listeners lacked the expectations about accentuation patterns that were apparent in lower AQ-Comm indi-

viduals. Thus, AQ-Comm seems to predict the use of prosodic prominence in perception and processing, a factor which may be relevant in predicting the extent to which the interpretation of *only* is prosodically sensitive.

1.4. Present study

In the present study, we investigate how ambiguous the interpretation of *only* is in simple SVO sentences. As described above, this relates to how prosodically ambiguous VP and object focus are in such constructions. We utilize a task that, to our knowledge, has not been applied before to the question of this ambiguity, namely an auditory sentence completion task. In this task, participants listened to a prompt sentence containing *only* and then recorded their own follow-up sentence, which reflected their expectations about the continuation of the narrative. This open-ended task was intended to access more directly the participants' spontaneous interpretation of the sentences and minimize interference from experimenter-provided contexts. Another advantage of this approach is that it provided a measure of listeners' interpretation of a spoken sentence without relying on metalinguistic judgements. Crucially, to explore prosody's influence on listeners' interpretation, the accentual pattern of the prompt sentence was systematically manipulated. Additionally, listeners completed the AQ questionnaire, allowing us to investigate the extent to which autistic traits might modulate interpretation of the sentences.

2. Methods

2.1. Materials

Twelve SVO constructions with preverbal *only* (e.g., "*he only dried the bowls*") were designed as auditory stimuli in a sentence completion task. Each of these constructions was introduced by a short prepositional phrase (e.g. "*After Stephan ate dinner...*"). Three recordings of each test sentence were produced by a ToBI-trained male American English speaker so as to create three prosodic conditions. These conditions were defined by the relative pitch accent prominence of the nuclear accented objects, corresponding to low relative DO prominence (7a), medium relative DO prominence (7b), and high relative DO prominence (7c). (See example stimuli set in the Appendix).

- | | | |
|---|----|-----|
| | H* | !H* |
| (7) a. After Stephan ate dinner... he only dried the BOWLS. | | |
| | H* | H* |
| b. After Stephan ate dinner... he only dried the BOWLS. | | |
| | | H* |
| c. After Stephan ate dinner... he only dried the BOWLS. | | |

For each of the test sentences, a short continuation prompt was also created, either "*he didn't?*" or "*she didn't?*" depending on the subject of the test sentence. This prompt was presented orthographically following the auditory test sentence to elicit participants' continuations of those test sentences. Additionally, 17 filler sentences were recorded. The fillers had a variety of syntactic and prosodic structures, and appropriate prompts were created for each.

2.2. Participants

Ninety-five North American English speakers participated in the study through the Amazon Mechanical Turk online platform. All participants had received a "Masters Qualification",

rating them as high performing "workers" on the site. Each completed the AQ questionnaire, provided a sample recording to verify native speaker status, and then completed the sentence completion task.

3. Procedures

3.1. Sentence completion task

There were 6 pseudorandomized, counterbalanced lists, each consisting of 12 test sentence and 15 fillers. After a training session with 3 example sentences, participants clicked a button to listen to an audio recording, followed by a continuation prompt on the screen, and then "continued the story" by recording a sentence of their own, beginning with a written prompt. For instance, a participant might hear the sentence "*After Stephan ate dinner, he only dried the bowls*" in one of the prosodic conditions and then see the written prompt "*He didn't..?*". After the prompt, participants were asked to record their own follow-up (e.g., "*He didn't wash the plates*").

Participants' recordings were then transcribed and coded for the focused constituent given in response. For instance, if, in response to *...he only dried the bowls*, a participant gave as a completion a sentence like "*He didn't wash the plates*", the response was coded as VP focus, since the material of the entire VP contrasted with the stimulus sentence. A follow-up like "*He didn't dry the cutlery*", on the other hand, was coded as DO focus. Participants who produced 4 or more non-contrastive follow-ups, like "*He didn't eat dinner at home every night, after all.*" were excluded from the results (n=4).

3.2. AQ

In addition to the sentence completion task, each of the participants completed the AQ questionnaire. This 50-item, self-report survey assesses autistic-like personality traits in the general (i.e. neurotypical) adult population. The AQ-Comm subscale was the only measure used in the analysis below, since, as described above, this measure is the one that has been found to correlate with sensitivity to prosody, specifically prosodic prominence. Again, higher scores indicate more autistic-like traits along the communication dimension.

4. Results

We were interested in three basic questions regarding the interpretation of *only*. First, do listeners show an overall bias towards its association with the VP or DO? Second, does prosody (here, relative prominence of the DO) correspond to a preferred interpretation? Third, do individual differences in AQ-Comm scores modulate any effect prosody might have?

4.1. Overall preference and effects of prosody

Overall, participants tended to produce sentences that contrasted an alternative to the test sentence's DO, but repeated the given verb (e.g. "*She didn't water the cucumbers*" as a follow-up to "*She only watered the tomatoes*"). Thus, there was an overwhelming preference to interpret *only* as associating with the DO (79.3% DO completions versus 20.6% VP completions overall).

This absolute preference for DO association may be related to the task itself. In creating their own sentences, participants had to generate alternatives to the verbs and/or direct objects in the stimulus sentences. It is possible that the burden of gen-

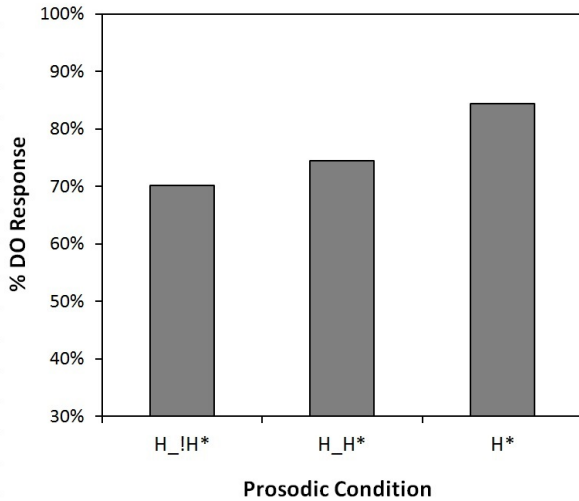


Figure 1: Percentage of DO Responses by Prosodic Condition

Table 1: Results for fixed-effects factors in the logistic regression model of DO responses.

	β	SE	z	p
(intercept)	1.438	.288	4.98	<.001
H* vs. H*_H*	.800	.211	3.77	<.001
H*_!H* vs. H*_H*	-.301	.187	-1.61	= .1
H* vs. H*_!H*	1.101	.210	5.24	<.001

erating alternatives is greater for verbs and verb phrases than for nouns. As a result, when asked to create a novel sentence, participants simply may have found it easier to produce an alternative noun phrase alone than a contrasting verb and noun phrase. This increased burden may account for the low production overall of VP alternatives. Alternatively, *only* may, as part of its specification, preferentially associate with a narrow focus.

However, as shown in Figure 1, this bias does not appear to be equally strong across all prosodic conditions. In particular, the higher the DO's relative prominence, the greater the (numerical) likelihood of a DO response. To test this pattern statistically, we used mixed-effects logistic regression to predict the outcome variable "DO response". This first analysis did not consider individual differences (see below). Using the *anova* function in *R*, simple models were compared with the fixed-effects factors *prosodic condition* and *trial*; maximal random effects structures were tested [21]. From preliminary models, a fixed-effect factor with a p-value larger than .1 was dropped if it did not significantly decrease model fit; random-effects were permitted to remain in the model if this did not decrease model fit. The final model warranted only the factor *prosodic condition* as fixed-effect, random intercepts for *subject* and *item*, and a by-subject random slope for *trial*.

This model, which used the mid-prominence H_H* condition as the default level, indicated the following. First, the H* condition elicited more DO responses than the H_H* condition ($p < .001$) and the H*_!H* condition elicited insignificantly fewer ($p = .1$). A model was refit with H_H* as the default level of prosody, and indicated that the H_!H* also produced significantly fewer DO responses than the H* condition ($p < .001$). The output of the model is shown in Table 1. Thus, the primary finding was that the H* condition (i.e., highest rela-

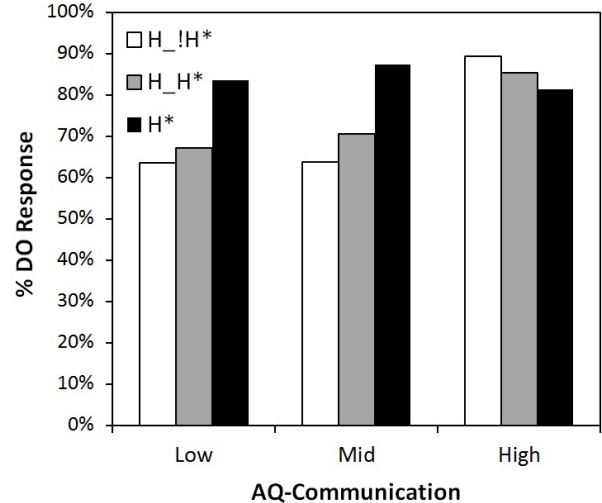


Figure 2: DO responses for each prosodic condition, as a function of participants' AQ-Comm scores. "Mid" scores are those ± 1 s.d. around the mean, "Low" and "High" above or below. (AQ-Comm was a continuous variable in the statistical model).

tive nuclear/prenuclear DO prominence) produced significantly more DO responses than the two conditions with lower relative prominence on the DO.

4.2. Individual differences

Figure 2 plots the effect of prosodic condition on DO responses as a function of AQ-Comm; as can be seen, the simple effect for prosody just described appeared to hold less reliably for individuals with reduced communication abilities by that measure. To test the significance of this pattern, a new round of modeling was carried out as above but including an interaction between *prosodic condition* and *AQ-Comm score*. (Note that, although Figure 2 above shows participants grouped in terms of the distribution, AQ-Comm was a continuous variable in the model). The same fixed- and random-effects structure was retained, with the addition of a fixed-effects term for AQ-Comm and its interaction with prosodic condition. The output of the modeling that included AQ-Comm scores is shown in Table 2.

Table 2: Results for fixed-effects factors in the logistic regression model of DO responses.

	β	SE	z	p
(intercept)	1.49	.001	1664.7	<.001
H* vs. H*_H*	.719	.001	798.6	<.001
!H* vs. H*_H*	-.312	.001	-347.1	<.001
AQ	.341	.001	379.3	<.001
H* vs. H*_H* x AQ	-.331	.001	-367.7	<.001
H_!H* vs. H*_H* x AQ	-.005	.001	-5.2	<.001
H* vs. H*_!H*	-.324	.114	-2.84	<.01

The simple effects of prosody in the model above were obtained here also (although now, with AQ-Comm in the model, and held at its mean, all three prosodic conditions were significantly separated). There was also a simple effect for AQ-Comm; high AQ-Comm participants showed a stronger overall tendency to give DO responses. An interaction between

prosodic condition and AQ-Comm was also significant; higher AQ-Comm scores were associated with smaller differences in DO responses between conditions, and in the opposite direction.

5. Discussion

In summary, our results show a strong preference to interpret *only* as associating with a narrowly focused DO in ambiguous sentences. However, it was also found that this bias was somewhat sensitive to (a) the relative pitch accent prominence of the DO, and (b) individual differences in autistic traits. We consider the implications of these findings here.

First, considering prosody’s role, the significant distinction seemed to be between sentences with vs. those without a prenuclear pitch accent; test sentences with a single H* pitch accent on the DO produced more DO responses relative to both the conditions with prenuclear H* pitch accents. Varying the DO’s accent from a full-fledged H* to a downstepped !H* did not produce a significant difference in responses (although there was trend in the direction of downstepped nuclear accents producing the fewest DO responses of all). These patterns resemble a recent study by [22], which also investigated prosody’s role in focus disambiguation, though using different methodology. Notably, both that study and the present one support claims that the presence of a prenuclear accent on a verb has the ability to cue broad rather than narrow focus in SVO constructions. While this stands in contrast to the initial versions of the FPH as discussed above, it is consistent with the predictions set forth by Selkirk in more recent work [23]. Under the widely-held view that *only* is focus sensitive, we assume that the distribution of DO responses across prosodic conditions was due in part to listeners’ use of prosody to determine the scope of that focus. Interestingly, however, the sensitivity to the prosodic manipulation was inversely related to AQ-Comm scores. This finding is also consistent with previous work [22, 13], and thus provides another data point linking this measure of cognitive processing style with the use of prominence in sentence comprehension, though not necessarily other aspects of prosody such as phrasing (see [24]). It is possible that AQ-Comm scores reflect pragmatic processing, as has been assumed elsewhere [17, 25], and are thus most predictive of sensitivity to accentuation since this aspect of prosodic structure is closely related to pragmatic interpretation in English.

One possible interpretation of the present study’s experimental results distinguishes semantic and pragmatic effects on the interpretation of *only*. To account for the overwhelming bias towards DO association (again, approximately 80% overall), we could assume that part of the semantic meaning of *only* is to select for a narrow focus, but that pragmatic factors may also contribute modestly to the final focus interpretation. Under the additional assumption that AQ-Comm scores reflect sensitivity to pragmatic factors, this explains the smaller influence of prosody in these individuals and their higher overall tendency towards DO responses. That is, higher AQ-Comm individuals were engaging in more straightforwardly “semantic” processing of *only*.

6. Conclusion

In conclusion, a sentence completion task was used to investigate interpretation of simple SVO sentences containing *only*. Our results revealed a strong overall bias toward assigning narrow DO focus to such sentences. However, when a prenuclear

accent was present on the verb, this bias was somewhat weaker. Interestingly, prosody’s role was less pronounced in individuals with more autistic traits as measured by AQ-Comm. Tentatively, we suggest that our results reflect these participants’ decreased sensitivity to pragmatic factors in the interpretation of *only*, namely the prosodic cues that encode the size of a focus constituent.

7. Appendix: Example Stimuli

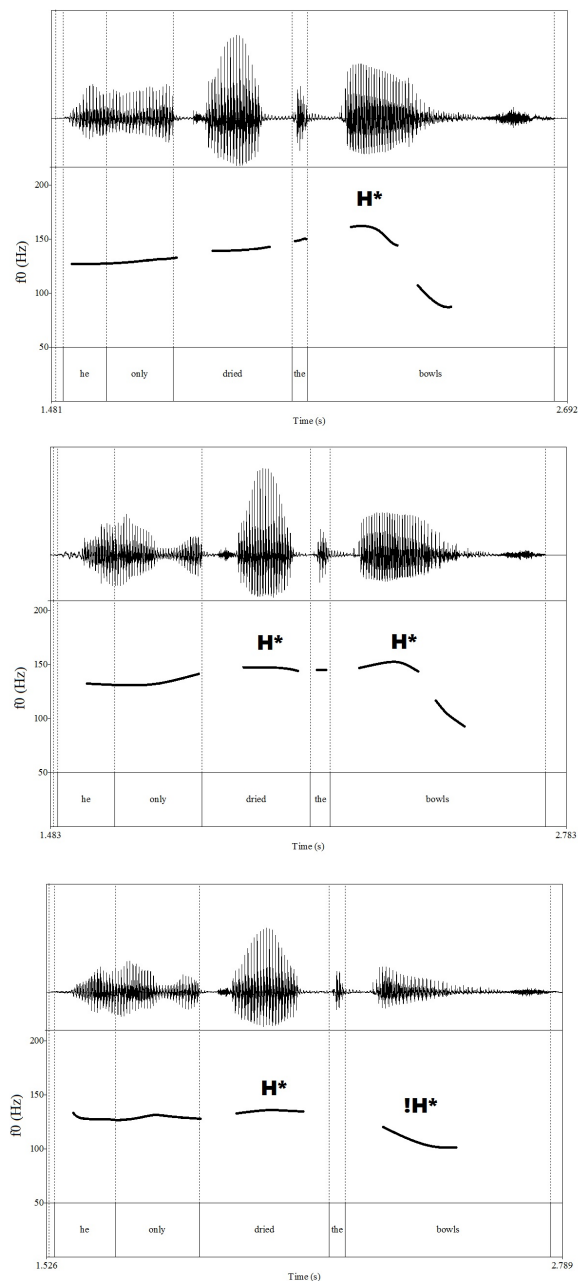


Figure 3: Example SVO stimulus item “He only dried the bowls.” in the three prosodic conditions.

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