Processing *Only:* Scalar Presupposition and the Structure of ALT(S)

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1. Motivation and Summary. There is a long-standing puzzle in L1 acquisition of *only* first reported in Crain et al.'94 and replicated since in a variety of languages: children up to age 6 display surprising difficulties understanding sentences with "subject-*only"* such as (1a) while seemingly having no difficulty understanding sentences with "VP-*only",* (1b). Moreover, when children misconstrue (1a) they understand it to have the meaning of (1b). E.g. Kermit's answer to the question *What happened?* in (1a) is judged to be true relative to the scene in (1c) and the justifications given indicate that (1a) is assigned the meaning expressed by (1b).

(1) a. Only the cat is holding a flag. c.
b. The cat is only holding a flag.

We show, in Exp.1, that adults exhibit a parallel processing asymmetry during language comprehension and propose an account of processing difficulty for a sentence with *only* based on the notion of "Easily Scalable Constituents" (ESCs). The account explains the basic effect and correctly predicts relative processing difficulty for subject-*only* and VP-*only* in Exps.2-3.

2. Exp.1. We use a timed inference task to study adult comprehension of sentences with *only.* Participants read a set of statements, which jointly describe a situation similar to the one depicted in (1). E.g. *1. The cat is holding a flag. 2. The goose is holding a flag and a balloon. 3. The frog is holding a balloon.* Below these "premises" there is a button labeled "What happened?". Upon clicking that button, the premises disappear and a new statement is presented that does or does not truthfully describe the situation characterized by the set of statements. Participants indicate whether the set of statements supports the target sentence by clicking "True" or "False". Half of the stories support a subject-*only* and when they do don't support its corresponding VP-*only* statement and vice versa. Dependent measures are accuracy and response time (RT). 24 target items were interspersed with 34 filler items. Stimuli were presented on Ibex, participants were recruited via Amazon's Mechanical Turk. Significance is determined by maximally specified LMEM for log-transformed RTs and GLMEM with logistic regression for accuracy. **Results** (n=64) indicate high accuracy (>80%) but no difference between conditions. RTs, however, show a main effect of attachment (subject-*only* >> VP-*only*). Taking RT as a proxy for processing difficulty, this parallels the L1 data.

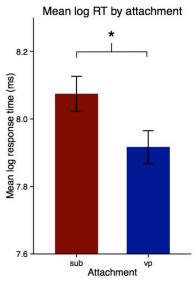

Figure 1

3. Assumptions. 3.1 ***Only****:* We assume that *only* is a sentence level operator, which (i.) presupposes its prejacent, (ii.) asserts that all non-weaker elements in the set of alternatives to the prejacent (ALT(S)) are false and, crucially, (iii.) presupposes that the prejacent is relatively low ranked among the elements in ALT(S) ("scalar presupposition" – cf. Horn'69, Rooth'92, Bonomi&Casalegno'93, Klinedinst'05, Beaver&Clark'08, Zeevat'09, etc.).

(2) $[\![\text{Only}]\!]^w(\text{ALT(S)})(\text{S})$ is defined only if $[\![\text{S}]\!]^w = 1$ & $\lambda w.[\![\text{S}]\!]^w$ is relatively low ranked among propositions expressed by the members of ALT(S); if defined $[\![\text{Only}]\!]^w(\text{ALT(S)})(\text{S}) = 1$ if $\forall \text{S'} \in \text{ALT(S)}[[\![\text{S'}]\!]^w = 1 \rightarrow \lambda w.[\![\text{S}]\!]^w \subseteq \lambda w.[\![\text{S'}]\!]^w]$

3.2 ALT(S): We propose an amended version of Fox&Katzir's '11 algorithm to generate ALT(S). Specifically, elements of ALT(S) are identical to S modulo replacement of F-marked constituents in S (X_F), with members of the substitution source for X_F ($SS(X_F)$). $SS(X_F)$ consists of (i.) lexical items, (ii.) sub-constituents of X_F, (iii.) discourse salient constituents, or (iv.) constituents generated via (i.-iii.). **3.3** Based on 3.1 and 3.2 we define the notion of an "**Easily Scalable Constituent**" (ESC): A constituent in the prejacent of *only*, S, is "easily scalable" if it is relatively easy to generate ALT(S) such that the scalar presupposition of

only(S) can be satisfied. **3.4 Surface distribution of focus-associates (X_F) of *only*:** X_F of subject-*only* has to be the subject or a constituent inside the subject, X_F of VP-*only* has to be the VP or a constituent inside the VP.

4. Proposal. Comprehending *only*(S) requires identifying the focus associate of *only* in S (X_F), which entails locating F in S. ESCs are natural targets for this search process, they "attract F". *Only*(S) is relatively difficult to process if S does not contain an ESC in an eligible position for X_F (as defined in 3.4) but does contain an ESC in an ineligible position as such an ESC will distract the search for X_F.

5. Predictions and further Experimental Evidence. Exp.1: The subject of (1a,b) is not an ESC since F-marking of the subject (given 3.2) results in ALT(S) ={*The cat is holding a flag. The goose is holding a flag. The frog is holding a flag.*}. This set of alternatives cannot be ranked based on entailment because sentences like *The cat and the goose are holding a flag* are not in ALT(S). Hence, unless the context provides an independent method of ranking the alternatives, (1a) is infelicitous. The object in (1a,b), by contrast, is an ESC. The context (specifically premise 2) mentions the conjunctive DP *a flag and a balloon.* Thus, F-marking of the object results in ALT(S) = {*The cat is holding a flag. The cat is holding a flag and a balloon.*}. This set of alternatives does contain a stronger alternative to the prejacent of (1a,b). Hence, (1b) is relatively easy. **Exp.2a,b**: Inherently scalar expressions like numerals are predicted to be ESCs since substitution by a lexical alternative is always possible. This predicts that numerals should make processing *only*(S) easier when they are in an eligible position in S and more difficult when they are in ineligible positions. Exp.2a tests this pre-diction with *one* in subject position, as in (3). **Results** (n=64) show a main effect of attachment on Accuracy and RT with subject-*only* easier than VP-*only* (Fig.2). Exp.2b uses *one* in object position with *a* as a baseline, as in (4). **Results** (n=64) show a main effect of quantifier type on RT: (4a) takes longer than (4b), Fig.3.

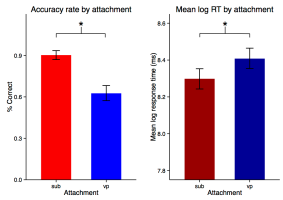

Figure 3

(3) a. Only one of the animals is holding a flag.
b. One of the animals is only holding a flag.
(4) a. Only the cat is holding one flag.
b. Only the cat is holding a flag.

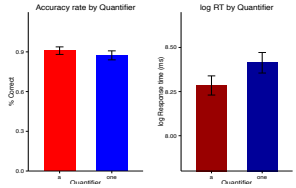

Figure 2

Exp.2a,b both show that *one* facilitates processing *only*(S) when it is in an eligible position and makes it more difficult when it is in an ineligible position. This is as predicted since numerals are ESCs and, thus, attract F. **Exp.3a,b** investigate the effect of conjunctive DPs inside S. Our proposal predicts that they are ECS since the algorithm to generate ALT(S) defined in 3.2 yields the closure under conjunction if S contains a conjunctive DP and this will satisfy the scalar presupposition of *only*. Exp.3a,b use similar material to Exp.1 except that the stories support target sentences with conjunctive subjects (Exp.3a, (5)) and conjunctive objects (Exp.3b, (6)).

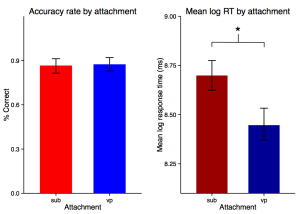

Figure 4

(5) a. Only the cat and the goose are holding a flag.
b. The cat and the goose are only holding a flag.
(6) a. Only the cat is holding a flag and a balloon.
b. The cat is only holding a flag and a balloon.

Results (n=64 for both): Exp.3a shows no effects, but a comparison with Exp.1 reveals an interaction on RTs driven by RTs for VP-*only* being longer in Exp.3a than in Exp.1. Exp.3b (Fig.4) shows a main effect of attachment on RT wth subject-*only* longer than VP-*only*. Moreover, a comparison with Exp.3a reveals an interaction driven by longer RTs for subject-*only* in Exp.3b than in Exp.3a. This is expected if conjunctive DPs attract F and, like numerals, facilitate processing *only*(S) when they are in eligible positions while impeding processing *only*(S) when they are in ineligible positions.