Q-spreading in child language as distributive inferences

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Rationale. We discuss a case of implicatures that are curiously absent in adult language, even though they are predicted to occur given standard assumptions. It will be proposed that these missing implicatures might be present in child language.

Missing implicatures in adult language. Disjunctions in the scope of a possibility modal trigger so-called free choice inferences: *John can read Article 1, Article 2, or Article 3* implies *John can read Article 1 and John can read Article 2 and John can read Article 3* (e.g., [Kamp, 1973]). Such inferences are typically derived as implicatures, crucially relying on the fact that 'P(A1 or A2 or A3)' triggers 'domain alternatives' of the form: P(A1 or A2), P(A1 or A3), and P(A2 or A3) (see Fox [2007]). Assuming that we can take free choice inferences as evidence that the disjunction activates these alternatives, under most theories of implicatures (say Chierchia et al. [2008] for concreteness), the predicted implicature enriched interpretation of (1a) is (1b). (With P(__) now being *Every girl took __*, we obtain the inferences that 'not every girl took Apple 2 or Apple 3 or Apple 4', hence 'some girl took Apple 1', and similarly for all apples: 'some girl took Apple x'.) This prediction is borne out, these implicatures are called distributive inferences (see, e.g., Spector, 2006 and quantitative data in Crnič et al., 2015).

(1a)   Every girl took Apple 1, Apple 2, Apple 3, or Apple 4.

(1b)   Every girl took Apple 1, Apple 2, Apple 3, or Apple 4 and every apple was taken by a girl.

Indefinite noun phrases also trigger free choice effects in the scope of a possibility modal: in a context with three salient articles, a possible reading of *John can read an article* is *John can read A1 and he can read A2 and he can read A3*. As it was the case for disjunction, this free choice reading may be taken as evidence that indefinites activate domain alternatives, which further predicts that (2a) could be read as (2b). But there is no introspective evidence for such a reading in adults. We thus have a puzzle of missing distributive inferences for the indefinite.

(2a)   Every girl took an apple.

(2b)   Every girl took an apple and every apple was taken by a girl.

Children: q-spreading as distributive inferences. Children seem to have the exact interpretation of the indefinite in the scope of the universal quantifier that is predicted, yet unattested, in adult language. That is, they would often report that (2a) is false in a situation in which there is an apple not taken by a girl, even if all of the girls have indeed taken an apple. This phenomenon in child language has been called quantifier spreading (hereafter q-spreading), Type A error, or exhaustive pairing error (Inhelder and Piaget 1964, a.o.). Given the previous discussion, an account of q-spreading is readily available: whatever is responsible for the different behaviors of indefinites and disjunctions in the scope of a universal quantifier in adult language is not operative in child language. Q-spreading in child language may thus be the result of implicatures, derived by negating domain alternatives that indefinite noun phrases ought to activate, since they give rise to free choice inferences. *Empirical coverage.* This account (henceforth implicature account of q-spreading) connects well with two empirical aspects of the phenomenon. First, it can easily capture its developmental path. In a longitudinal study, Aravind et al. [2017] found that young children showed little q-spreading, but that the amount of q-spreading errors increased with age. Such developmental path is well-explained if q-spreading is the result of implicatures, and if the rate of implicatures increases with age (Noveck, 2001, a.o). Second, it has been noticed that certain manipulations of experimental context can significantly reduce the amount of q-spreading (Crain et al., 1996, Philip, 2011). For instance, Philip [2011] reports that what is considered to be a topic in the experimental context can have an influence on q-spreading. When the topic surrounding the experimental question is about the subject noun, there is less q-spreading than when the topic is about the indefinite noun. In other words, the salience of subject to the detriment of object reduces quantifier spreading. An implicature account of q-spreading has the potential to

capture this context dependency too, since context naturally influences implicature derivation. *Experiment.* To support this argument for this particular instance of implicatures, we have conducted an experiment in which we show that contextual manipulations similar to those reported with children can have an influence on distributive inferences of disjunction, which are the adult counterpart of q-spreading. We collected adults' data of sentences such as (1a) varying i) CONDITION: target condition in which every girl took an apple, but there was an apple mentioned in the disjunction that was not taken, true controls, in which every girl took an apple and all of the apples appearing in the disjunction were taken, and false controls, in which not every girl took an apple and ii) CONTEXTUAL SALIENCE (with or without manipulation). The main goal of the contextual manipulation was to increase the salience of the subject: this was done by having filler items in which the quantifier and the noun in the subject vary and by keeping the length of the disjunction constant. As expected, we found that this contextual manipulation leads to a decrease in the amount of distributive inferences of disjunction (as revealed by a significant interaction with between CONDITION (true controls or targets) and CONTEXTUAL SALIENCE (with or without manipulation): $p = .03$; cf. the increase in the amount of true responses in the target condition of the salience group in Figure 1. It is thus possible that similar mechanisms are implicated in both the reduction of quantifier spreading in children observed by Philip [2011] and the reduction of distributive inferences of disjunction in adults observed in our experiment (perhaps because the salience of the alternative trigger — disjunction or indefinite — is reduced).

Difference between adults and children. One major question that stems out of the implicature theory of q-spreading is what precisely differs between adults and children, and why adults don't have q-spreading with indefinites. We discuss here two possible solutions. (1) Both children and semanticists might be mis-analyzing free choice effects: in particular, while disjunctions activate domain alternatives, indefinites might not. (2) Semanticists and children may be missing a piece of adult grammar that blocks the distributive inferences with indefinites for adults. Let us see what this piece of grammar could be like. Chierchia [2013] has independently proposed that *every* creates intervention effects for the exhaustification of negative polarity items such as *any* in its scope. The universal quantifier might thus create intervention for the exhaustification of the alternatives of indefinites, and therefore implicatures for sentences such as (2a) would be blocked. If the implicature account of q-spreading in child language is correct, then the difference between children and adults would be that children are not sensitive to intervention effects. It seems to us, however, that this solution involves many non-trivial stipulations.

Conclusion. Given current assumptions on the similarity of alternatives activated by indefinites and disjunctions, the fact that disjunctions, but not indefinites, trigger domain implicatures in the scope of the universal quantifier is puzzling. We have proposed that even if current semantic theories turn out to be incomplete for adults, they may be entirely correct for children, then, with q-spreading effects revealing the expected presence of domain implicatures.

References Athulya Aravind, et al. Childrens quantification with every over time. Glossa: a journal of general linguistics, 2(1), 2017. G. Chierchia. Logic in Grammar. Oxford University Press, 2013. Gennaro Chierchia et al. The grammatical view of scalar implicatures and the relationship between semantics and pragmatics. Semantics: An International Handbook of Natural Language Meaning, 2008. Stephen Crain et al. Quantification without qualification. Language Acquisition, 5(2):83-153, 1996. Luka Crnic et al. Scalar implicatures of embedded disjunction. Natural Language Semantics, 23(4):271-305, 2015. Danny Fox. Free choice and the theory of scalar implicatures. In Presupposition and implicature in compositional semantics, pages 71-120. Springer, 20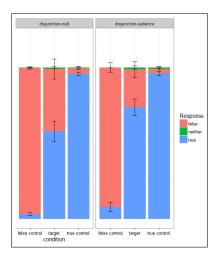07. Barbel Inhelder and Jean Piaget. The early growth of logic in the child: Classification and seriation. Routledge and Kegan Paul, 1964. Hans Kamp. Free choice permission. In Proceedings of the Aristotelian Society, volume 74, pages 57-74, 1973. Ira A Noveck. When children are more

Figure 1: Effect of shift in saliency from object to subject on distributive inferences

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