BUCLD 45 Proceedings
To be published in 2021 by Cascadilla Press
Rights forms signed by all authors

Quantifier-Spreading under Negation

Fulang Chen, Leo Rosenstein, and Martin Hackl

1. Introduction

When shown a picture of three elephants, each washing a car, and an extra car that is not being washed by an elephant (Fig. 1), children often respond negatively to the sentence in (1), and point to the extra car to justify their answer.

(1) Every elephant is washing a car.

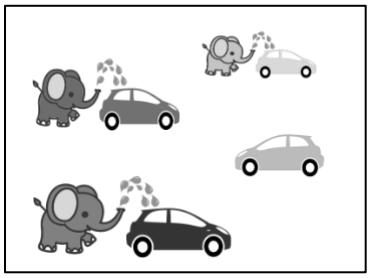

Fig. 1: Extra-Object Scenario

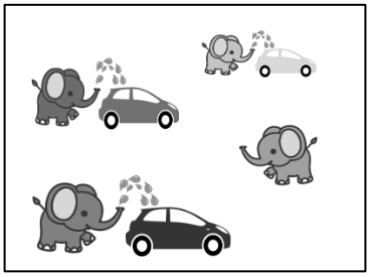

Fig. 2: Extra-Agent Scenario

This phenomenon, broadly known as quantifier-spreading (henceforth QS), has been shown to occur in various scenarios with various sentence types (e.g., Inhelder and Piaget 1958, 1964; Roeper & de Villiers 1991; Philip & Takahashi 1991; Takahashi 1991; Philip 1995; a.o.).[1] In this paper, we focus on QS that occurs in an extra-object scenario like Fig. 1, with transitive sentences like (1), in which the subject is quantified by *every* and the object is an indefinite. It has been observed that children start responding negatively to sentences like (1) in an extra-

* Fulang Chen, Leo Rosenstein, Martin Hackl, Massachusetts Institute of Technology, Department of Linguistics & Philosophy. ccater@mit.edu (Chen). We are grateful to all the children and adult participants and to the children's parents and teachers for their cooperation. We would like to thank Dóra Kata Takács for helping with this project in its early stages, and our undergraduate research assistants for their assistance with data collection. Our thanks also go to participants at the MIT Language Acquisition Lab meetings and the Language Acquisition Workshop in New England (LAWNE), reviewers and attendees at the BUCLD45 conference for their valuable comments and suggestions.

1. Inhelder and Piaget (1964) observe that some children response negatively to sentences like *All the circles are blue* in a scenario in which not only all the circles are blue, but also some squares are blue. Philip and Takahashi (1991) and Takahashi (1991) find that QS occurs also with intransitive sentences like *Every boy is driving*, which has an implicit object.

object scenario when they *stop* responding positively to (1) in an extra-agent scenario, e.g. Fig. 2, where there is an extra elephant that is not washing a car (Aravind et al. 2017).

Here, we investigated whether QS occurs under negation. Namely, whether children respond positively to sentences like (2) when there is an extra object (car) in the picture.

(2) Not every elephant is washing a car.

To our knowledge, this has not been systematically studied. Various accounts of QS have suspected that at the heart of QS are grammatical and/or pragmatic factors that reinforce the relevance of the extra object (e.g., Philip 1995, 2012; Drozd 2001; Geurts 2003; Kiss & Zétényi 2017; a.o.), which we will discuss in detail in section 4. Our critical sentence in (2) provides a testing ground for accounts that derive an enriched meaning of the critical sentence via implicature computation, for example, a recent proposal by Denić and Chemla (2020).

Denić and Chemla (2020) draw an analogy between indefinites and disjunction. It is known that disjunction, in the nuclear scope of *every*, gives rise to *distributive inferences* (Spector 2006; Crnič et al. 2015; a.o.). For example, the sentence in (3a) gives rise to the inference that (3b), a *domain alternative* which is logically stronger than (3a), is false. This, together with (3a), entails that 'Car 4 is washed by an elephant'. It is easy to see that by negating other stronger domain alternatives of the form in (3b), one can obtain the distributive inferences in (3c).

(3) a. Every elephant is washing Car 1, Car 2, Car 3 or Car 4.
b. Every elephant is washing Car 1, Car 2, or Car 3.
c. Every car (Car 1, Car 2, Car 3 or Car 4) is washed by an elephant.

For Denić and Chemla (2020), QS occurs when the original proposition, (1), is enriched with the distributive inferences in (3c), as in (4a). The second conjunct of (4a) is proposed to be derived by negating stronger domain alternatives activated by the indefinite object, with the assumption that the domain of the indefinite object is identified with the contextually given set of cars. The details of the computation are given in (4b).

(4) a. Every elephant is washing a car, and …
… every (contextually relevant) car is washed by an elephant.
b. ∀ Elephant ∃ Car∈*D* Washing (Elephant, Car) & ...
…∀ *D′*: *D′* ⊂ *D* ¬ [∀ Elephant ∃ Car∈*D′* Washing (Elephant, Car)],
where *D* = {Car 1, Car 2, Car 3, Car 4}

Importantly, this proposal predicts that QS should not occur under negation. This is because the presence of negation in (5a) reverses the logical strength of the domain alternatives, and negating domain alternatives of the form in (5b), which are logically weaker than (5a), would yield a contradiction with (5a), as in (6),

which can be paraphrased as 'not every elephant is washing a car, and every elephant is washing a car'. This computation suggests that sentences like (5a) do not invoke distributive inferences in the sense of Denić and Chemla (2020), and adult-like interpretation should be obtained.

(5) a. Not every elephant is washing a car (Car1, Car2, Car3, or Car 4).
b. Not every elephant is washing Car1, Car2, or Car3.

(6) $\neg \forall$ Elephant $\exists$ Car$\in D$ Washing (Elephant, Car) & ...
... $\forall D'$: $D' \subset D \neg$ [$\neg \forall$ Elephant $\exists$ Car$\in D'$ Washing (Elephant, Car)]
where D = {Car 1, Car 2, Car 3, Car 4}

We note that children's understanding of sentences involving disjunction in the nuclear scope of *not every* has been studied by Notley et al. (2012). They find that children correctly assign a conjunctive meaning to disjunction in the nuclear scope of *not every*, indicating that children correctly identify the nuclear scope of *not every* as a downward-entailing environment. However, since the aim of their study is not to investigate QS under negation, no conclusions can be drawn about Denić and Chemla's (2020) prediction. Our study, by contrast, is designated to test this prediction directly.

2. The child experiment

2.1. Participants

Thirty-eight 3- to 5-year-old English-speaking children (range: 3;1 - 5;8, mean: 4;5) participated in this experiment. The child participants were tested individually at their day-care.

2.2. Design, materials, and procedure

The experiment consists of three critical conditions (*Baseline 1*, *Baseline 2* and *Target*) and a total of nineteen experimental trials, including four trials on each critical condition, two practice trials at the beginning of the experiment and a filler trial after every three trials on the critical conditions. We employed the standard picture verification task; on each trial, a picture and a critical sentence were presented to the child participant by the experimenter who played as a puppet. On *Baseline 1* trials, the picture depicts an extra-object scenario (see Fig. 1) and the critical sentence has the form in (7):

(7) This is a picture where every elephant is washing a car.

On *Baseline 2* trials, the picture depicts an extra-agent scenario (see Fig. 2), and the critical sentence has a variant form of (7), which contains *not every*:

(8) This is a picture where not every elephant is washing a car.

Finally, on *Target* trials, the picture depicts an extra-object scenario, and the critical sentence has the form in (8), which contains *not every.* Table 1 summarizes our design.

Table 1: Summary of Critical Conditions

Condition	Picture	Critical sentence
Baseline 1	Extra-**Object** Scenario	**Every** elephant is washing a car.
Baseline 2	Extra-**Agent** Scenario	**Not every** elephant is washing a car.
Target	Extra-**Object** Scenario	**Not every** elephant is washing a car.

On each trial, the critical sentence was presented as the puppet's description of the picture. Then, the child was asked to judge whether the puppet was right or wrong about the picture, and to justify their answers.

2.3. Results

We used the Baseline 1 condition to identify *spreaders*, those who responded negatively to the critical sentence (while adult-like responses would be positive), and pointed to the extra object to justify their answers. We used the Baseline 2 condition to assess whether children know the presence of negation in the critical sentence reverses the truth value of the proposition in the scope of negation. If children understand the meaning of *not every*, we expect them to respond positively to the critical sentence (like adults), and point to the extra agent to justify their answers. Finally, we used the Target condition to investigate whether QS occurs under negation; namely, whether children respond positively to the critical sentence (while adult-like responses would be negative), and point to the extra object to justify their answers.

Since we are interested in how spreaders perform on the Target condition, we excluded from data analysis four "right"-sayers and three "wrong"-sayers who responded positively or negatively regardless of the condition. We also excluded six other children whose responses were adult-like on the Baseline 1 condition. Table 2 provides a summary of the response profile of each subgroup.

Table 2: Summary of Different Response Profiles

Condition	Adult	**Spreader** (n = 25)	**"Right"-sayer** (n = 4)	**"Wrong"-sayer** (n = 3)	**Other** (n = 6)
Baseline 1	Right	Wrong (79%)	Right (100%)	Wrong (100%)	Right (100%)
Baseline 2	Right	Right (90%)	Right (100%)	Wrong (100%)	Right (67%)
Target	Wrong	Right (80%)	Right (100%)	Wrong (100%)	Wrong (67%)

We find that the twenty-five spreaders' responses were mostly non-adult-like on both Baseline 1 and Target conditions, where they were shown pictures that depict an extra-object scenario. Specifically, they responded negatively 79% of the time to the critical sentence on the Baseline 1 condition, and they responded positively 80% of the time to the critical sentence, which contains *not every*, on the Target condition. By contrast, their responses were adult-like 90% of the time on the Baseline 2 condition. When asked to justify their answers, they frequently pointed to the extra object or agent in the picture. We also note that the six other children whose responses were adult-like on the Baseline 1 condition showed comparable performance on Baseline 2 and Target conditions, where the critical sentence contains *not every*; their responses were adult-like 67% of the time.[2]

The details of the spreaders' performance on each critical condition are presented in Table 3 and Fig. 3.

Table 3: Spreaders' (n = 25) Mean Correctness and Distribution of Correct Answers per Condition

Condition	Mean correct	SD	# of children w/ 4 or 3, 2 or 1, and 0 correct		
Baseline 1	0.84	0.75	0	16	9
Baseline 2	3.6	0.58	24	1	0
Target	0.8	1.19	4	7	14

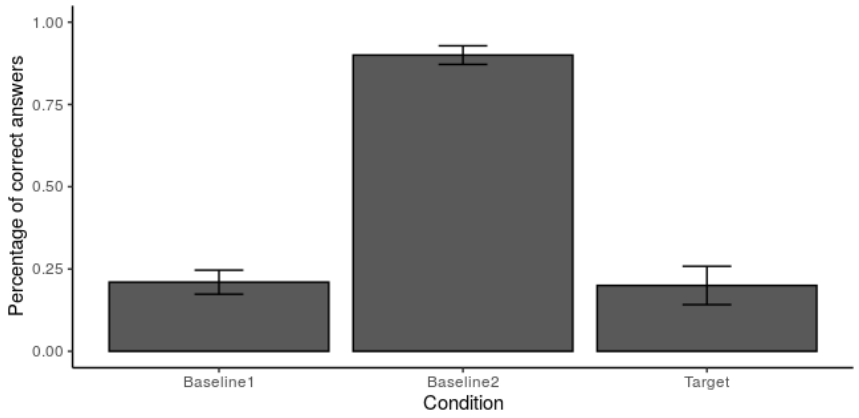

Fig. 3: Spreaders' (n = 25) Percentage of Correct Answers per Condition

2. Three of the six children responded negatively to the critical sentence without pointing to the extra agent on two of the four trials on the Baseline 2 condition, explaining the degraded overall performance. The degraded overall performance on the Target condition results from two of the six children who responded positively to the critical sentence and pointed to the extra object on three of the four trials. Due to the small size of this subgroup, we cannot draw further conclusions about their performance.

To statistically assess whether the spreaders' performance was above or below chance-level performance on each critical condition, we compared their percentage of correct answers on each condition with chance-level accuracy using the Mann-Whitney U test. The results indicate that the spreaders' percentage of correct answers is significantly below chance-level accuracy on Baseline 1 ($z = 2.12$, $p < .05$, two-tailed) and Target conditions ($z = 3.12$, $p < .01$, two-tailed), while their percentage of correct answers is significantly above chance-level accuracy on the Baseline 2 condition ($z = -4.69$, $p < .00001$, two-tailed).

2.4. Discussion

The findings of this experiment demonstrate the insensitivity of QS to negation when negation is present in the critical sentence. When shown a picture depicting an extra-object scenario, children who often responded negatively to sentences like *every elephant is washing a car* often responded positively to sentences like *not every elephant is washing a car*, and they pointed to the extra object to justify their answers in both cases. Thus, the prediction of Denić and Chemla (2020), namely, QS does not occur under negation, is disconfirmed.

When shown a picture depicting an extra-agent scenario, children responded positively to the critical sentences, which contains *not every*. We take this to indicate that children know the presence of negation in the critical sentences reverses the truth value of the proposition in the scope of negation.

We draw these conclusions by assessing children's responses based on what we have assumed to be adult-like responses. It is important to confirm that adults perform in expected ways under our experimental setup. To validate the design and materials for our experiment, we also conducted an adult control study, which we discuss in detail in the next section.

3. The adult control experiment

Sixty-six English-speaking adult participants were recruited via Amazon Mechanical Turk. The experiment was hosted on Ibex Farm using the design and materials identical to the child experiment – there were three critical conditions: Baseline 1, Baseline 2, and Target, and a total of nineteen trials, including twelve trials on the critical conditions and seven practice or filler trials (see section 2.2 for details). We again employed the standard picture verification task; on each trial, the adult participant was presented with a picture and a critical sentence, and was asked to judge whether the critical sentence was true or false relative to the picture. The adult participant was given fifteen seconds to choose from one of the three options: *True*, *False*, and *I cannot tell*. Then, they were asked to provide a justification for their answer.

Fifteen adult participants were excluded from data analysis because they failed to meet the inclusion criterion of 5/7 accuracy on the practice and filler items combined. When analyzing the data from the remaining fifty-one adults, we treated any *I cannot tell* responses as incorrect responses. We find that the adults'

responses were correct 77% of the time on the Baseline 1 condition, 82% of the time on the Baseline 2 condition, and 69% of the time on the Target condition (see Fig. 3).

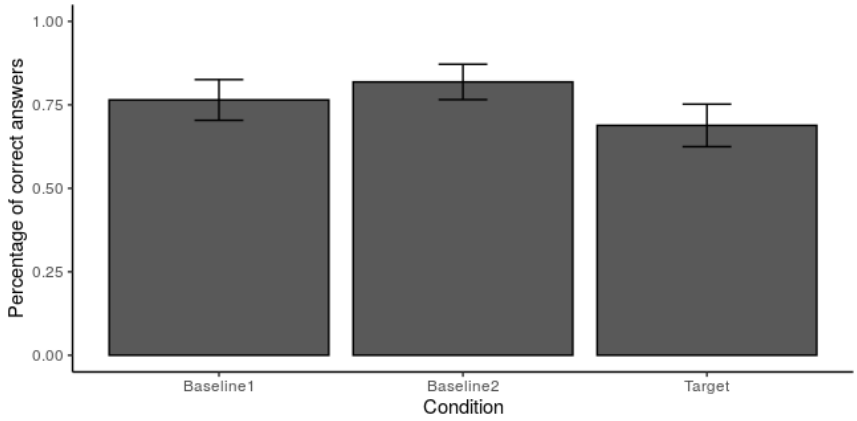

Fig. 4: Adults' (n = 51) Percentage of Correct Answers per Condition

The adult participant' performance on each condition was also statistically assessed using the Mann-Whitney U test. The results indicate that their percentage of correct answers is significantly above chance-level accuracy on Baseline 1 ($z = -4.52$, $p < .00001$, two-tailed), Baseline 2 ($z = -5.65$, $p < .00001$, two-tailed) and Target conditions ($z = -3.34$, $p < .001$, two-tailed).

We conclude that adults' accuracy rates are comparable across conditions, and that adults derive the truth condition of the critical sentences in expected ways, explaining the above chance-level accuracy rates. The findings from the child experiment and the adult control experiment call for an explanation for the difference between children and adults.

4. General discussion

From the child experiment we concluded that QS occurs under negation, which disconfirms Denić and Chemla's (2020) implicature-based account of QS. To account for QS and its insensitivity to negation when negation is present in the critical sentence, we suggest that the source of the second conjunct of (9) is presuppositional, rather than an implicature.

(9) (Not) every elephant is washing a car, and …
… every (contextually relevant) car is washed by an elephant.

Specifically, we propose that contextual factors, such as the near perfect one-to-one relationship between elephants and cars in Fig. 1, exploit children's

inclination to suppose a non-accidental relation R between elephants and cars, leading to an indexed or anaphoric, relational construal of the indefinite object in the critical sentence, as in (10).

(10) (Not) every elephant$_E$ is washing a R_E car.
⇒ (Not) every elephant$_E$ is washing its$_E$ car.

We hypothesize in addition that this construal of the indefinite object has a *domain presupposition* in the sense of Moltmann (2006). For children, we suggest that the presupposed set of cars is identified with the contextually given set of cars, as in (11a), and that the descriptive content of the indefinite object, under a relational construal, requires each car in the presupposed set to relate to an elephant, as in (11b), which can be paraphrased as 'every (contextually relevant) car relates to an elephant.'

(11) a. D = {Car1, Car2, Car3, Car4}
b. $D \subseteq$ {C: C is a car and C relates to an elephant E}

We propose that QS arises from (11). Since presuppositions project through negation, we also predict QS to occur under negation. Specifically, in the extra-object scenario, (11) leads children to accommodate an unseen elephant which is not washing its car (cf. Drozd 2001; Philip 2012). In Fig. 5, the bolded texts indicate what are contextually given, and the italicized texts indicate what are implied given the relational construal of the indefinite object and (11). It is easy to see that QS is expected to occur when the unseen elephant (Elephant 4) is added to the restrictor set of *every* (cf. Philip 2012).

Elephant 1	**Elephant 2**	**Elephant 3**	*Elephant 4*
|	|	|	|
Elephant 1's	*Elephant 2's*	*Elephant 3's*	*Elephant 4's*
Car 1	**Car 2**	**Car 3**	**Car 4**

Fig. 5: Children's Interpretation of Extra-Object Scenario

Our proposal diverges from Denić & Chemla's (2020) implicature-based account of QS on the mechanism of enriching the meaning of the critical sentence. What we have proposed is a context-dependent, presupposition-based mechanism of establishing the quantificational domain of *every* from a relational construal of the indefinite object in the critical sentence, which predicts QS to be insensitive to negation when negation is present in the critical sentence. We now turn to other accounts that attribute QS to grammatical and/or pragmatic factors that reinforce the relevance of the extra object. While these accounts may also predict QS to occur under negation, we hope to demonstrate that our proposal is superior to these accounts.

Drozd (2001) suggests that *every*, which is a strong quantifier in the adult

grammar, is interpreted as a weak quantifier in the child grammar. To determine whether *every elephant is washing a car*, adults consider whether the car-washing property denoted by the nuclear scope of *every* holds for the contextually given set of elephants, which is the set denoted by the restrictor of *every*. But according to Drozd (2001), children derive the truth condition of the sentence from the contextually given set of car-washing elephants and the set of elephants which *should* be washing a car, which they infer from the context. When there is an extra car that is not being washed by an elephant in the context, children infer that there is an unseen elephant which should be washing the extra car. They respond negatively to *every elephant is washing a car*, because the set of car-washing elephants is not identified with the set of elephants which should be washing a car.

Like Drozd (2001), Geurts (2003) also assumes that children give a weak-quantifier construal of *every*, but unlike Drozd (2001), Geurts (2003) suggests that the quantificational domain of *every* is underdetermined in children's semantic representation of *every elephant is washing a car*, and is determined by what is contextually more salient. When there is an extra car in the picture, children understand the sentence to mean 'every car is washed by an elephant', because they identify the domain of *every* with the set of cars, which is more salient in the context.

Roeper and de Villiers (1991) pursue the hypothesis that children interpret sentence-initial *every* not as a determiner quantifier, but as an adverbial quantifier similar to the sentential adverb *always*. Along the same lines, Philip (1995) proposes to assign an event-quantificational semantics to *every* in the child grammar: *every elephant is washing a car* can be paraphrased as 'for every event such that there is an elephant or a car, an elephant is washing a car in that event'. When there is an extra car in the picture, children judge the sentence to be false because the extra car is taken to indicate an event in which no elephant is washing the car.

All of the aforementioned accounts attribute QS to a non-adult-like construal of *every*, but other studies have demonstrated children's adult-like knowledge of the monotonicity properties of *every* – in particular, children have been shown to know that *every* is downward-entailing in its restrictor (Gualmini et al. 2003). As mentioned at the end of section 1, children have also been shown to know that *not every* is downward-entailing in its nuclear scope (Notley et al. 2012). These findings challenge the aforementioned accounts, which mess with the monotonicity properties of (*not*) *every* by assigning a weak quantifier or event quantifier construal to *every*. Unlike the aforementioned accounts of QS, we assume with Aravind et al. (2017) that children have acquired the meaning of *every* when they stop making errors with sentences like *every elephant is washing a car* in an extra-agent scenario and at the same time start making errors with the sentences in an extra-object scenario. Our proposal is in line with the developmental trajectory of *every*: we correctly predict that children would respond positively to the critical sentences in both extra-object and extra-agent scenarios when *every* is initially misconstrued as a plural existential quantifier, as proposed by Aravind et al. (2017), and they would respond negatively to the

critical sentences in both extra-object and extra-agent scenarios when the meaning of *every* is acquired.

Another reason to think QS is not indicative of non-adult-like understanding of *every* is that the rate of QS responses correlates with the way the extra-object scenario is construed. Crain et al. (1996) argue that children's negative responses to sentences like *every elephant is washing a car* when shown a picture depicting an extra-object scenario stem from the fact that the picture fails to provide the children with an alternative outcome in which the critical sentence is false. Specifically, Crain et al. (1996) hypothesize that QS occurs because the *condition of plausible dissent* is not satisfied in the standard picture verification task. They conducted an experiment in which children were presented with a story instead of a picture before they are asked to judge whether the critical sentence was true or false relative to the story. In a sample story, every skier drank a cup of hot apple cider, but there were many extra drinks they could choose from. Some of the skiers initially wanted to drink soda instead of hot apple cider, but later changed their minds. The condition of plausible dissent is satisfied because the story presents and rejects a possible alternative (that some of the skiers drank soda) to the actual outcome (that every skier drank a cup of hot apple cider). Crain et al. (1996) reports that children responded positively to sentences like *every skier drank a cup of hot apple cider* 88% of the time.

Sugisaki and Isobe (2001) show that satisfying the condition of plausible dissent is not the key to the decrease in the rate of QS responses. They employed the standard picture verification task and presented children with pictures where there are many extra objects. In a sample picture, there are four cats, each kicking a soccer ball, and many extra soccer balls collected in a basket. When asked to judge sentences like *every cat is kicking a soccer ball*, children responded positively 87.5% of the time. Kiss and Zétényi (2017), too, employed the standard picture verification task; they presented one group of children with pictures of stick figures on a white background, while presented the other group of children with real-life pictures rich in irrelevant, episodic details. When the picture depicts an extra-object scenario, children in the latter group made 50% fewer errors than children in the former group. According to Kiss and Zétényi (2017), QS occurs when the extra object is understood as "one of the intentionally introduced visual signals, whose linguistic equivalent must be present in the appropriate linguistic representation of the stimulus"; increasing the number of extra objects or including episodic details in the visual stimuli has the effect of removing the pragmatic inference that the extra object(s) must be relevant to the interpretation of the critical sentence.

Philip (2012) also attributes QS to pragmatics. Similar to our proposal, he suggests that QS occurs with *every elephant is washing a car* when there is an extra car in the picture, because children infer from the extra car the existence of an unseen elephant which is not washing the extra car, and they include the unseen elephant in the quantificational domain of *every*. He explains that unlike adults, who rely on world knowledge to deduce that the extra car is *irrelevant*, because it is not indicative of an unseen elephant, children determine that the extra car is

relevant (and thus implies the existence of an extra elephant), because it is *salient* – its presence spoils the otherwise one-to-one relationship between elephants and cars.

Contrary to Philip (2012), who attributes QS to the salience of the extra object, our proposal achieves the result that the extra car relates to an unseen elephant when the *one-to-one relationship between the elephant and the car* is salient in the context, leading children to suppose a relational construal of the indefinite object in the critical sentence. Our proposal also sheds new light on the pragmatic factors underlying QS. We predict that contexts that discourage a relational construal of the indefinite object should yield lower rates of QS responses. Building on Kiss and Zétényi's (2017) proposal, we suggest that by increasing the number of extra objects or including episodic details in the visual stimuli, children are discouraged from supposing a relational construal of the indefinite object in the critical sentence, because the one-to-one relationship between the agents and the objects is no longer salient.

Finally, our experiments suggest a difference between children and adults. If QS arises from a relational construal of the indefinite object in the critical sentence for children, one might wonder whether the same construal of the indefinite would lead adults to make QS errors. The findings of the adult control experiment might suggest that adults do not suppose a relational construal of the indefinite object in the critical sentence (possibly because adults rely on world knowledge to deduce that cars do not relate to elephants); alternatively, it is possible that adults do not make QS errors even when the critical sentence has the form (*not*) *every elephant is washing its car*. The difference between children and adults could be that while children identify the domain presupposition of *its car* with the contextually given set of cars, and infer the existence of an unseen elephant which is not washing the extra car based on the bound interpretation of *its car*, adults identify the domain presupposition of *its car* based on its bound interpretation – since the extra car does not appear to relate to an elephant, it will not be included in the domain presupposition of *its car*.

To summarize, we have presented empirical evidence that QS occurs under negation; namely, children respond positively to sentences like *not every elephant is washing a car* when there is an extra object (car) in the picture. This challenges accounts that derive an enriched meaning of the critical sentence via implicature computation, including a recent proposal by Denić and Chemla (2020). We have proposed a context-dependent, presupposition-based mechanism of establishing the quantificational domain of *every* from a relational construal of the indefinite object in the critical sentence, which not only predicts the insensitivity of QS to negation when negation is present in the critical sentence while leaving the monotonicity of *every* intact, but also sheds new light on the pragmatic factors underlying QS.

References

Aravind, Athulya, Jill de Villiers, Peter de Villiers, Christopher J. Lonigan, Beth M. Phillips,

Jeanine Clancy, Susan H. Landry, et al. 2017. Children's quantification with *every* over time. *Glossa: a journal of general linguistics* 2(1): 43. 1–16.

Crain, Stephen, Rosalind Thornton, Carole Boster, Laura Conway, Diane Lillo-Martin & Elaine Woodams. 1996. Quantification without qualification. *Language Acquisition* 5(2). 83–153.

Crnič, Luka, Emmanuel Chemla, & Danny Fox. 2015. Scalar implicatures of embedded disjunction. *Natural Language Semantics* 23: 271–305.

Denić, Milica & Emmanuel Chemla. 2020. Quantifier Spreading in Child Language as Distributive Inferences. *Linguistic Inquiry* 51(1): 141–153.

Drozd, Kenneth. 2001. Children's weak interpretations of universally quantified questions. In Melissa Bowerman & Stephen Levinson (eds.), *Language acquisition and conceptual development*, 340–376. Cambridge: Cambridge University Press.

Geurts, Bart. 2003. Quantifying kids. *Language Acquisition* 11(4): 197–218.

Gualmini, Andrea, Luisa Meroni & Stephen Crain. 2003. An asymmetric universal in child language. In Matthias Weisgerber (ed.), *Proceedings of Sinn und Bedeutung 7*, 136–148. Konstanz: Universität Konstanz.

Inhelder, Bärbel & Jean Piaget. 1958. *The growth of logical thinking from childhood to adolescence.* London: Routledge and Kegan Paul.

Inhelder, Bärbel & Jean Piaget. 1964. *The early growth of logic in the child, classification and seriation.* London: Routledge and Kegan Paul.

Kiss, Katalin É. & Tamás Zétényi. 2017. Quantifier spreading: children misled by ostensive cues. *Glossa: a journal of general linguistics* 2(1): 38. 1–20.

Notley, Anna, Rosalind Thornton & Stephen Crain. 2012. English-speaking children's interpretation of disjunction in the scope of *not every*. *Biolinguistics* 39: 484–522.

Philip, William. 1995. *Event quantification in the acquisition of universal quantification.* Amherst, MA: University of Amherst Massachusetts dissertation.

Philip, William. 2012. Acquiring knowledge of universal quantification. In Jill de Villiers & Tom Roeper (eds.), *Handbook of generative approaches to language acquisition*, 351–394. New York, NY: Springer.

Philip, William & Mari Takahashi. 1991. Quantifier spreading in the acquisition of *every.* In Thomas Maxfield & Bernadette Plunkett (eds.), *Papers in the acquisition of WH* (University of Massachusetts occasional papers), 283–301. Amherst, MA: GLSA.

Roeper, Tom & Jill de Villiers. 1991. The emergence of bound variable structures. In Thomas Maxfield & Bernadette Plunkett (eds.), *Papers in the acquisition of WH* (University of Massachusetts occasional papers), 225–265. Amherst, MA: GLSA.

Spector, Benjamin. 2006. Aspects de la pragmatique des opérateurs logiques. University of Paris 7 dissertation.

Sugisaki, Koji & Miwa Isobe. 2001. Quantification without qualification without plausible dissent. In Ji-Yung Kim & Adam Werle (eds.), *The semantics of underrepresented language in the Americas* (University of Massachusetts occasional papers), 97–100. Amherst, MA: GLSA.

Takahashi, Mari. 1991. Children's interpretation of sentences containing *every*. In Thomas Maxfield & Bernadette Plunkett (eds.), *Papers in the acquisition of WH* (University of Massachusetts occasional papers), 303–329. Amherst, MA: GLSA.