

# The Strength of the Universal Quantifier in Child Language

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## 1. Introduction

Children's understanding of the universal quantifier (e.g., *every* in English) has been investigated since the work of Inhelder and Piaget (1964).<sup>1</sup> One finding reported in the literature is that children sometimes produce non-adult responses to sentences containing the universal quantifier. One kind of context that can elicit a non-adult response from children is depicted in Figure 1. There are three boys in the figure, and each boy is riding an elephant, but crucially there is an 'extra' elephant, i.e., one that is not being ridden. Presented with such a context, 4- to 6-year-old children who are asked the question *Is every boy riding an elephant?* sometimes say 'no,' whereas adults usually answer 'yes' (see e.g., Philip 1995). If asked to justify their answer, the children who say 'no' typically point to the elephant that is not being ridden by anybody (the 'extra' object). This response has been interpreted as showing that, in such conditions, children require a one-to-one (symmetrical) relation between the elements of the set denoted by the subject noun (*boy*) and the elements of the set denoted by the object noun (*elephant*).

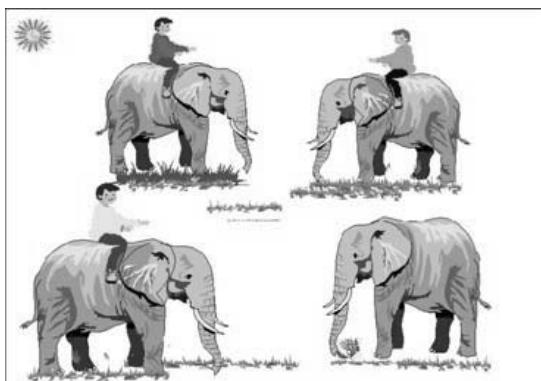


Figure 1

- (1) Is every boy riding an elephant?

The occurrence of 'symmetrical responses' by children in the experimental context exemplified by Figure 1 has been the subject of considerable controversy. Several accounts of children's non-adult responses have been offered. Broadly speaking, these accounts can be partitioned into ones that attribute children's non-adult responses to deviant linguistic analyses of sentences containing quantified expressions, and ones that attribute these responses to non-linguistic factors.

An early non-linguistic account for children's symmetrical responses to sentences with the universal quantifier was advanced by Freeman, Sinha and Stedmon (1982). A particular felicity

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<sup>1</sup> See also Crain, Thornton, Boster, Conway, Lillo-Martin and Woodams (1996), Drozd (1996), Freeman, Sinha and Stedmon (1982), Gualmini (2003), Gualmini, Meroni and Crain (2003), Meroni, Gualmini and Crain (2006), Philip (1995), Roeper and de Villiers (1991), and Takahashi (1991), among others.

condition on the use of the universal quantifier was appealed to by these authors, building on a proposal by Russell (1948) and elaborated upon by Wason (1965), who labeled it the condition of *plausible denial*. To satisfy the condition of plausible denial, the answer to the question *Is every boy riding an elephant?* must be in doubt. If not, this might lead children to produce non-adult responses. Here is how Freeman et al. (1982) put it:

“When a speaker asks a question about the presence of ‘all the Xs’, he is implicitly requesting the hearer to carry out an exhaustive search to check that no X is missing. Asking someone such a question is only legitimate ‘socio-dialogically’ if there is at least the possibility that some X is (or some Xs are) in actuality missing.” (Freeman et al., 1982; p. 64)

Thus, according to Freeman et al. (1982), a universally quantified question such as *Is every boy riding an elephant?* is pragmatically plausible only if there is the possibility that at least one boy is missing – a boy who could have been riding the ‘extra’ elephant. In light of these considerations, Freeman et al. pointed out that previous research that evoked the non-adult response from children failed to satisfy this felicity condition that they associate with the use of the universal quantifier, because the possibility that some boy was ‘in actuality missing’ was never entertained in the experimental context.

Another non-linguistic account was proposed by Crain, Thornton, Boster, Conway, Lillo-Martin and Woodams (1996). This account is based on the observation that children consistently interpret sentences with the universal quantifier in the same way as adults do in some experimental paradigms. Thus, it was suggested by Crain et al. that children’s non-adult behavior in previous research could be attributed to the inappropriateness of the discourse contexts in which they were tested. Children’s consistent adult-like performance in the Crain et al. study was attributed to the satisfaction of a felicity condition on judgments of truth or falsity, not just on sentences with the universal quantifier. Crain et al.’s claim is that it is felicitous to ask someone to judge the truth or falsity of a sentence only if the discourse context establishes a possible outcome that would have warranted a different judgment from the one initiated by the actual outcome. In short, both a ‘true’ and a ‘false’ judgment should be supported in the context.

Although similar in spirit to the account proposed by Freeman et al. (1982), the account proposed by Crain et al. (1996) generalizes across constructions, rather than applying only to universally quantified sentences. This also has consequences for the particular ways each of these accounts might propose to eliminate the putative pragmatic infelicity of the contexts provided in previous research. Since for Freeman et al. the infelicity rests on the universal quantifier, the infelicity can be removed solely by establishing the existence of a boy who may have gone missing, but didn’t. By contrast, for Crain et al. the infelicity rests on the task itself – which is to provide a yes/no judgment. In the case at hand, this means that a statement like *Every boy is riding an elephant* is true and felicitous only if there is a possible outcome of the story, differing from the actual outcome, which would make the sentence false. For instance, one can also remove the infelicity, on this account, by introducing the possibility that one of the boys might choose to ride something besides an elephant, such as a donkey. Despite the differences, both Freeman et al. and Crain et al. suggest that a violation of pragmatic norms in certain experimental contexts resulted in children’s non-adult behavior. In such pragmatically infelicitous contexts, the accounts contend, children are led to override the experimental context in search of an alternative scenario which would make the target assertions or questions plausible.

Further evidence in favor of the non-linguistic account of children’s non-adult responses advanced by Crain et al. is reported in studies with adults, who were found to experience problems similar to those experienced by children in certain experimental contexts. In a series of eye-tracking experiments, Meroni, Crain and Gualmini (2001) and Meroni (2002) investigated the possibility that, despite their correct ‘yes’ responses to questions such as (1), adults are also sensitive to the felicity conditions identified by Crain et al. The experimental hypothesis was that adults are sensitive to these felicity conditions, but unlike children, adults are able to successfully make the necessary accommodations to the infelicitous contexts that elicit non-adult responses from children. On the non-linguistic accounts of children’s responses, adults would be expected to fixate on the elephant that no boy is riding in Figure 1, despite the fact that this elephant is irrelevant for deciding the correct answer to the question.

This expectation is based on the idea that in infelicitous contexts listeners are prompted to develop strategies, which are not purely linguistic, for deciding on the relevant meaning. The ‘extra’ elephant provides them with one easy way of making the utterance felicitous because it warrants the conjecture of an extra-boy who was supposed to ride that elephant (which is the strategy, we claim, children are also using). Thus, despite the fact that adults are able to ‘overcome’ the infelicity of the context, a behavioral indication that this strategy had been adopted should be manifested as an increase in fixation time on the ‘extra’ elephant.<sup>2</sup> Meroni et al. (2001) and Meroni (2002) found that adults were indeed puzzled by the presence of the ‘extra’ elephant in the infelicitous condition, as compared to a felicitous condition that contained an unriden donkey as well as an ‘extra’ elephant. The mean fixation time on the ‘extra’ elephant was significantly longer in response to pictures that did not satisfy the felicity conditions, as compared to pictures that did satisfy the felicity conditions (e.g., with both an ‘extra’ donkey and an ‘extra’ elephant).

In light of the experimental evidence suggesting that adults and children experience similar difficulties when presented with sentences with the universal quantifier in certain circumstances, it seems reasonable to maintain the hypothesis that children do not lack semantic competence in interpreting such sentences. The findings thus support the view that the failure to satisfy felicity conditions was responsible for children’s non-adult behavior in previous research. Nevertheless, recent proposals continue to attribute children’s non-adult responses to a non-adult linguistic analysis. In the next session we evaluate two such proposals, one by Drozd and van Loosbroek (2006) and another one by Geurts (2003).

## 2. The weakness of *every* as a source of children’s mistakes

Children’s non-adult behavior in response to universally quantified sentences has been attributed to defective linguistic analyses, in recent articles by Drozd and van Loosbroek (2006) and by Geurts (2003). A common feature of both accounts is the claim that children’s non-adult behavior is attributed, in part, to their failure to interpret *every* as a strong quantifier. Both accounts appeal to the distinction between strong and weak determiners introduced by Milsark (1974; 1977). In English, one diagnostic for classifying quantificational expressions as either strong or weak draws upon the observation that existential *there*-sentences may contain an indefinite noun phrase (weak) following the copula, but definite noun phrases (strong) are ungrammatical in the same linguistic environment, as shown in examples (2) and (3). This restriction on the kind of noun phrases allowed in *there*-sentences is known as the Definiteness Effect, a restriction exhibited by existential constructions, i.e., *there*-sentences, that extends to other strong determiners such as *every* and *most* (Milsark 1974; 1977).

- (2) There is a man in the garden.
- (3) \*There is the/every man in the garden.

The Definiteness Effect is one diagnostic for classifying determiners into strong and weak. Subsequently, Heim (1982) observed that a defining characteristic of strong determiners is that they carry a presupposition of existence. In fact, the presupposition of existence is what makes strong determiners incompatible with existential *there* constructions (see also, among the others, Barwise and Cooper 1981, Reuland 1983; 1985, and Zucchi, 1992). Intuitively, existential constructions assert the information that strong determiners presuppose, resulting in a pragmatic clash that renders such sentences ungrammatical.<sup>3</sup>

<sup>2</sup> It is worth mentioning also that 57% of the adults interviewed either provided a ‘no’ answer (like children) or asked the experimenter if ALL the relevant boys were in the picture, in the infelicitous condition. This is consistent with previous work by Freeman et al. (1982), who found that 17 of 20 adults produced symmetrical responses to universally quantified sentences, for example, when presented with a picture of three cups, each on a saucer, and one saucer without a cup on it.

<sup>3</sup> There are other theories that try to account for the definiteness effect, some from a purely syntactic point of view. However, the semantic analyses generally appeal to the presupposition of existence of the strong quantifiers

At this point, let us return to the accounts of children's symmetrical responses that turn on the distinction between strong versus weak quantification. We begin with the proposal advanced by Drozd and van Loosbroek (2006), called the Weak Quantification account. As noted, the Weak Quantification account maintains that the source of children's non-adult responses is a non-adult grammatical analysis. The account contends that children's non-adult interpretation of the universal quantifier *every* mirrors a possible interpretation of sentences containing the weak quantifier *many* in the adult language. Consider (4), from Westerstahl (1985).

- (4) Many Scandinavians have won the Nobel Prize in literature.

It has been suggested that (4) is ambiguous. One reading of (4) evaluates the number of Scandinavians who have won the Nobel Prize in literature relative to the number of Scandinavians, with *many* applying to the denotation of the subject noun, *Scandinavians*. The other purported reading evaluates the number of prize winners who are Scandinavian relative to the number of Nobel Prize winners, with *many* applying to the denotation of the verb phrase, *won the Nobel Prize in literature*. On this reading, the sentence could be true if only a few Scandinavians won the Nobel Prize in literature, since the total set of Nobel Prize winners is quite small. According to Drozd and van Loosbroek (2006), children's symmetrical responses result from the availability of a similar analysis for children, on which the universal quantifier *every* applies to the verb phrase, an analysis adults assign to sentences with *many*, but not to sentences with *every*. On children's non-adult analysis, the universal quantifier *every* applies to the set of elephants mentioned in the verb phrase, rather than to the set of boys mentioned in the subject noun phrase, as it must on the adult analysis. According to Drozd and van Loosbroek (2006), the non-adult reading makes the sentence *Every boy is riding an elephant* true if and only if every elephant is being ridden by a boy. This analysis is the basis for children's 'no' responses to questions such as (1) in Figure 1, on the Weak Quantification account.

Another linguistic account of children's non-adult responses to universally quantified sentences has been proposed by Geurts (2003). On this account, the origin of children's non-adult responses is a non-canonical mapping between syntax and semantics. We will call this the Weak Mapping account. Geurts' explanation of children's responses appeals to Discourse Representation Theory (see Kamp, 1981; Kamp and Reyle, 1993). Technicalities aside, the main intuition exploited in Geurts' account is that strong quantifiers like *every* impose a more complex semantic representation than weak quantifiers do. Turning to children's non-adult responses, Geurts (2003) does not locate the problem in children's mastery of universal quantification *per se*; the problem for children, on the Weak Mapping account, lies in the fact that the mapping between form and meaning is more complex for sentences containing strong quantifiers than for ones containing weak quantifiers. Thus, the proposal by Geurts (2003) shares with the Weak Quantification account the claim that children misinterpret sentences containing the universal quantifier *every* as if it was a weak quantifier. The proposal differs from the Weak Quantification account, however, in that (a) children's 'mistakes' are expected to occur with all strong quantifiers and that (b) children are argued to fall back on the mapping that is common to (the strong usages of) all weak determiners, rather than on the interpretive properties shown only by some weak quantifiers (e.g., *few* and *many*). For present purposes we will ignore the differences in the accounts proposed by Drozd and van Loosbroek (2006) and Geurts (2003), and we will focus instead on a common conclusion, i.e. that children interpret the universal quantifier *every* as a weak quantifier.

### 3. Assessing the strength of the universal quantifier *every* in child language

In this section we evaluate the proposals offered by Drozd and van Loosbroek (2006) and Geurts (2003). In particular, we concentrate on the claim that children treat the universal quantifier *every* as a weak quantifier. Putting children's symmetrical responses aside, the hypothesis that *every* is a weak quantifier predicts that it should pattern with other weak quantifiers. We evaluate this prediction by

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and also explain data from other languages which do not exhibit the syntactic definiteness effect, (i.e., Italian) and data from locative *there*-sentences (in which strong quantifiers can occur).

considering how *every* behaves with respect to another phenomenon that correlates with the strong-weak distinction. This phenomenon is known as the Semantic Definiteness Effect and is related to the interpretation of the verb *to have* (see Iatridou 1995). To illustrate, consider the sentences in (5) and (6).

(5) John has a car.

(6) John has the car.

Sentence (5) is ambiguous. It can mean that John is the owner of a car (*the possession reading*) or that John has temporary custody of a car (*the custodial reading*). By contrast (6) is unambiguous. It can only have the custodial reading. In short, an indefinite noun phrase, as in (5), may yield either a possession or a custodial interpretation, whereas a definite noun phrase, as in (6), yields only a custodial interpretation. Setting technical details aside, these facts point to a distinction in the interpretation of sentences containing the verb *to have* which ultimately relates *have*-sentences to the distinction between strong and weak determiners. The question is whether children know this distinction. Evidence of children's knowledge of the semantic definiteness effect would indicate their knowledge of the presuppositional force of a strong determiner, such as *the*.<sup>4</sup> Furthermore, if it could be shown that children's interpretation of the verb *to have* is sensitive to the strength of the determiner that follows it, this would provide a way to determine whether the universal quantifier is weak or strong for children. Consequently, this could be used to evaluate any account that attributes children's mistakes in response to sentences with the universal quantifier *every* to a failure to distinguish between strong and weak quantifiers.

To address this question, Meroni, Gualmini and Crain (2004) conducted an experiment using the Truth-Value Judgment task (Crain and McKee, 1985; Crain and Thornton, 1998). In a Truth Value Judgment task, one experimenter acts out a short story in front of the child, using props and toys. A second experimenter manipulates a puppet, who watches the story with the child subject. At the end of the story, the puppet utters the target sentence. At this point, the child is asked to evaluate the target sentence as a description of the story she has just seen. The acceptance of the target sentence is interpreted as indicating that the child can access an interpretation that makes the target sentence true in the context under consideration. By contrast, the rejection of the target sentence is taken as evidence that the child's grammar does not license any interpretation that makes the sentence true in the context.

In the experiment conducted by Meroni et al. (2004), the story established a context in which a particular character was the owner of a given object but did not have custody of that object at the time the target sentence was produced (i.e., at the completion of the story). The results show that in such a context, pre-schoolers, just like adults, accept a sentence containing an indefinite noun phrase, as in (7), but not a sentence containing a definite noun phrase, as in (8).

(7) Grumpy has a dog that Tommy brushed.

(8) Grumpy has the dog that Tommy brushed.

Meroni et al. interviewed thirty children (age: 3;09 to 5;05 -mean age 4;09). Children accepted sentences like (7), thereby accessing the possessive reading of the verb *to have*, 88% of the time. However, when the verb *to have* was followed by a definite noun phrase, as in (8), children accepted the target sentences only 10% of the time. The importance of the experimental findings documented by Meroni et al. (2004) is twofold. First, the findings show children's knowledge of the semantic definiteness effect (see Becker, 2000 for children's knowledge of the syntactic definiteness effect). In turn, this provides evidence of children's knowledge of the presuppositional force of a strong

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<sup>4</sup> Again, here we are assuming that, given the parallelism between *there*-sentences and *have*-constructions as hypothesized by Iatridou (1995), the restriction against strong determiners is motivated by the same principles.

determiner like *the*. Furthermore, the findings documented by Meroni et al. (2004) provide us with a diagnostics for the strength of any given quantifier in child language.

Recall that according to the accounts proposed by Geurts (2003) and Drozd and van Loosbroek (2006), children misinterpret sentences containing the universal quantifier *every* because they have problems in recognizing the presuppositional force of *every*. We have just provided empirical evidence of children's knowledge of the presuppositional force of the strong determiner *the*. The same research strategy can be followed to evaluate children's knowledge of the presuppositional force of the universal quantifier *every*. In the next section we report the findings of a different version of the experiment described above, one that replaces the definite determiner *the* with the universal quantifier *every*.

### 3.1 Experimental Design

This section presents the findings of an experiment designed to determine whether children distinguish between a possession reading and a custodial reading of the verb *to have* in sentences containing the universal quantifier *every*. Children were tested using the Truth Value Judgment task. They were asked to evaluate sentences like (9).

(9) Tigger has every rooster that the farmer fed.

In the experiment, the story establishes a context in which (a) Tigger owns the roosters that were fed by the farmer but (b) Tigger does not have custody of these roosters when the target sentence is uttered. We illustrate with a typical trial:

(10) This is a story about Tigger. Tigger wants to become a farmer. He already owns four roosters. Unfortunately he does not know what to feed his roosters and, as a result, the roosters are losing weight. Tigger decides to seek help from his friend, the Farmer, who knows a lot about animals. Tigger asks the Farmer to feed the roosters. Unfortunately, the Farmer only has enough food for three of Tigger's four roosters. Tigger thinks about it for a little while and then he decides which three of his roosters are most in need of food. He leaves these roosters to be fed, and he departs with the one remaining rooster. Before leaving, however, Tigger tells the Farmer that he will be back in an hour to pick up his roosters. Left alone, the Farmer feeds Tigger's roosters and then waits for Tigger to return. While he is waiting, Gonzo comes by. He sees the three roosters and says: "Hey Farmer, you have a lot of roosters. I love roosters, do you mind if I take them for a walk?" and the Farmer replies: "Actually these are Tigger's roosters. He asked me to take good care of them. But you can take them for a short walk. But you have to bring the roosters back before Tigger returns." At this point, Gonzo takes the three roosters that the Farmer fed for a walk.

In the story, the possession reading makes the sentence true, because Tigger is indeed the owner of the roosters that the farmer fed. By contrast, the custodial reading makes the sentence false, because Gonzo, not Tigger, has custody of every rooster that was fed by the farmer. Recall that *every* should behave on par with *the* in *have*-constructions. Both determiners belong to the class of strong determiners, which are referred to as presuppositional determiners, and are subject to the definiteness effect. It follows that children who know that *every* is a strong determiner should only assign a custodial interpretation to the verb *to have* if a universally quantified noun phrase follows it. Therefore, they are expected to reject the sentence, just as the child subjects rejected the sentences containing the verb *to have* followed by a definite noun phrase in the Meroni et al. study. By contrast, if children misinterpret a strong quantifier like *every* as a weak quantifier, they should be able to access the possession reading and, hence, they should accept the target sentence, in abeyance to the Maxim of Charity, just as child subjects accepted the sentences containing the verb *to have* followed by an indefinite noun phrase in the Meroni et al. study.

Fifteen children (age from 3;0;20 to 5;1;17 - mean age: 4;3;6) participated in the experiment. Every child was presented with four target trials and four filler trials to balance *yes* and *no* responses. The main finding was that children rejected the target sentences with the universal quantifier 88% of the time (i.e., on 53 of 60 trials). We take this result as evidence that children recognize the presuppositional force of the universal quantifier *every*. More importantly, the finding show that children know that *every* is a strong quantifier.

#### 4. Conclusions

The present paper contributes to the ongoing debate on children's interpretation of the universal quantifier. In particular, the study extends the class of linguistic phenomena beyond those investigated in previous literature, by drawing upon children's knowledge of the Definiteness Effect. A previous study by Meroni et al. (2004) investigated children's interpretations of *have*-constructions with the definite versus the indefinite determiner. The present study fills out the paradigm, by investigating *have*-constructions with the universal quantifier. Since both the definite determiner and the universal quantifier belong to the class of strong determiners, children's knowledge of the interpretation of *have*-constructions with both determiners is compelling evidence that they know the semantic properties associated with strong determiners, and do not mistake them for weak determiners. The responses by children to the universally quantified sentences containing the verb *to have* in the present experiment represent circumstantial evidence against two recent proposals, one by Geurts (2003) and the other one by Drozd and van Loosbroek (2006), which both claim that children analyze *every* as a weak quantifier. The results of our experiment undermine this conclusion. Children treat *every* on par with another strong determiner *the*, in contrast to a weak determiner like *a*. Finally, the findings lend additional support for non-linguistic accounts of children's mistakes in response to sentences with the universal quantifier in previous experiments.

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