AN ASYMMETRIC UNIVERSAL IN CHILD LANGUAGE[1]

Andrea Gualmini, Luisa Meroni and Stephen Crain

agualmin@wam.umd.edu, lu@wam.umd.edu, sc180@umail.umd.edu

Abstract

Investigations of sentences with the universal quantifier *every* have led to qualitatively different conclusions about children's linguistic knowledge. The aim of this paper is to investigate the extent to which children know the semantics of the universal quantifier *every*. A Truth Value Judgment task was conducted to determine whether young children know that the two arguments of the universal quantifier *every* differ in that only the restrictor, and not the nuclear scope, is downward entailing. Taken together with previous research, the experimental findings suggest that children's knowledge of the universal quantifier *every* runs deep, and includes the asymmetry in interpretation between the restrictor and the nuclear scope. The findings challenge recent claims that children lack knowledge of quantification.

1. Introduction

Children's interpretation of the universal quantifier *every* has been the subject of several recent investigations of child language. These investigations start from the observation, due to Inhelder and Piaget (1964), that some children show a systematic non-adult interpretation of sentences containing the universal quantifier *every*. In particular, Inhelder and Piaget (1964) discovered that pre-school and even school-age children sometimes respond "No" to the question in (1) in the context depicted in Figure 1, while adults respond affirmatively.
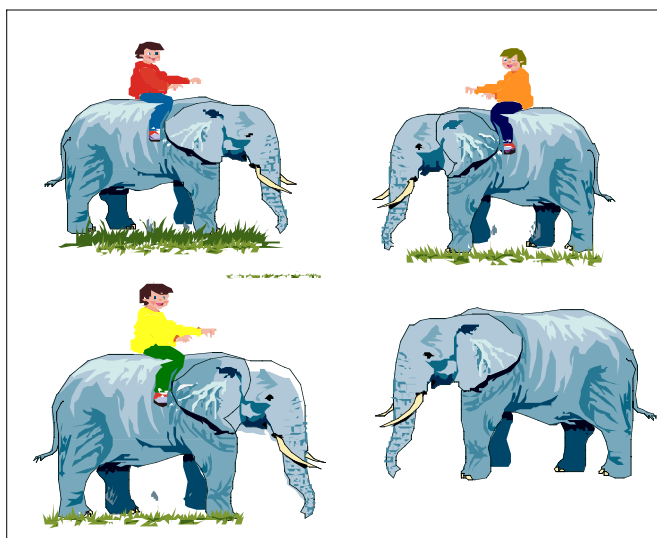
(1)   Is every boy riding an elephant?

Figure 1: The Extra Object Condition

When children are asked to justify their answer, they often point to the elephant that is not being ridden by any boy; this elephant is referred to in the literature as 'the extra-object.' Since children who respond in this fashion appear to demand symmetry (i.e., a one-to-one relation) between the set of boys and the set of elephants, this is called the *symmetrical response* (also the *exhaustive-pairing response*).

The finding from the Inhelder and Piaget study has been recently reexamined by a number of psycholinguists, some of whom have proposed grammatical explanations for children's non-adult behavior. We will focus on some common assumptions of the linguistic accounts of children's non-adult responses. Because these accounts attribute the different patterns of behavior of children and adults to the lack of full linguistic competence by children, the recent linguistic accounts of child language can be referred to together as the 'Partial Competence view.'

One such analysis of children's symmetrical responses was proposed by Philip (1995). This is called the Event Quantification account. The Event Quantification account attributes children's erroneous responses to a specific non-adult linguistic analysis. Under this account sentences containing the universal quantifier *every* are ambiguous for children.[2] First, children have the adult interpretation available to them. In addition to the adult interpretation, however, children sometimes assign an interpretation that makes these sentences false in the context in Figure 1. The idea is, roughly, that children analyze the universal quantifier *every* as an unselective binder, on analogy with temporal adverbs like *always* and *usually* in the adult grammar. In extending the adverbial analysis to the universal quantifier, Philip (1995) contends that the universal quantifier is a determiner that quantifies over events in child grammar, whereas it quantifies over individuals in the adult grammar. On the Event Quantification account, children's non-adult interpretation of the sentence *Every boy is riding an elephant* can be described as follows:

(2)   For every event *e* in which either an elephant or a boy participates, a boy is riding an elephant in *e*.

As (2) indicates, children's grammar licenses an interpretation that is more constrained than the adult interpretation. In order to make a sentence true on this interpretation, it is not sufficient for every boy to ride an elephant. An additional requirement must also be satisfied: for each event in which an elephant participates, there must be a boy riding that elephant. Since Figure 1 contains an elephant that is not being ridden by any boy, this additional requirement is not satisfied. Thus, guided by their grammars, these children sometimes give a negative answer to the question in (1) (see Philip (1995; 1996) for a more complete explanation).

A second variant of the Partial Competence view was advanced by Drozd and van Loosbroek (1998; 1999). This is called the Weak Quantification account. Like the Event Quantification account, the Weak Quantification account also assumes that children's non-adult responses are due to non-adult grammars, but this account ascribes a different non-adult interpretation to children. Essentially, the proposal by Drozd and van Loosbroek (1998; 1999) is that children's non-adult responses result from the application of the quantifier *every* to the set of elephants mentioned in (1). Whereas adults interpret the sentence *Every boy is riding an elephant* as indicated in (3), children's grammars are seen to not only contain the adult

---

[2] It bears observing that children who give the symmetrical response to questions like (1) also give (affirmative) adult-like responses.

interpretation in (3), but also a non-adult interpretation. As we understand it, the non-adult reading is along the lines of (4).

(3)   EVERY [boy] [λx (x is riding an elephant)]

        (boy ∩ λx [x riding an elephant]) ∈ EVERY (boy)

(4)   EVERY [elephant] [[λx (boy is riding x)]

        (elephant ∩ λx [boy is riding x]) ∈ EVERY (elephant)

The semantic representation in (4) makes the sentence *Every boy is riding an elephant* true if and only if every elephant is being ridden by a boy. This accounts for children's negative responses to questions like (1) in the context in Figure 1.

2.   A common assumption

The Event Quantification account and the Weak Quantification account have important differences. We shall put aside these differences, however, and focus on an assumption that is common to both accounts. Consider the affirmative counterpart of (1), in (5).

(5)   Every boy is riding an elephant.

A simplified logical form for (5) can be represented as in (6):

(6)   EVERY [boy] [λx (x is riding an elephant)].

In (6), the universal quantifier *every* serves as a function that takes an internal argument and an external argument: the internal argument (restrictor) is the semantic value of the noun phrase *boy* and the external argument (nuclear scope) is the semantic value of the predicate *is riding an elephant*. In set theoretic terms, the function expressed by the universal quantifier makes the sentence true if the set of boys is a subset of the set of entities that are riding an elephant. On this view, the syntactic structure of the sentence contributes to the logical form (and the semantic interpretation) in a transparent fashion.[3]

By contrast, the Event Quantification account and the Weak Quantification account assume that children can access an interpretation of (5) in which the two arguments of the universal quantifier *every* do not reflect the syntax in a transparent way. As we have seen, the Event Quantification account maintains that children access the interpretation in (7) in addition to the adult interpretation.

(7)   For every event *e* in which either an elephant or a boy participates, a boy is riding an elephant in *e*.

---

[3] The logical form is derived from the underlying syntactic structure via the application of quantifier raising (see May, 1977) or noun prefixing (see Heim, 1982).

The semantic representation in (7) does not restrict the application of the universal quantifier *every* to the events in which a boy participates, as in (6). Rather, the semantic representation in (7) extends the application of the universal quantifier *every* to include events in which an elephant participates. In other words, the internal argument of the universal quantifier not only contains the semantic value of the noun that combines with the universal quantifier *every* in the overt syntax (i.e., *boy*), but it also contains the semantic value of the noun phrase that resides in the direct object position in the overt syntax (i.e., *elephant*), i.e., in the external argument. In an analogous fashion, the Weak Quantification account maintains that children derive the meaning of sentences containing the universal quantifier *every* in a way that disregards the syntax of such sentences. On children's non-adult interpretation, the direct object is taken to be in the internal argument, as shown in (8).

(8)   EVERY [elephant] [[λx (boy is riding x)]

        (elephant $\cap$ λx [boy is riding x]) $\in$ EVERY (elephant)

To recap, we have reviewed two grammatical explanations of children's non-adult responses to sentences containing the universal quantifier *every*, the Event Quantification account and the Weak Quantification account. These accounts share the assumption that children access an interpretation that disregards the adult mapping between overt syntax and semantic interpretation. As a consequence, children should fail to display adult-like knowledge of any linguistic phenomena that distinguish between the two arguments of the universal quantifier. This prediction is worth following up, as we noted, because such accounts potentially undermine the Continuity Hypothesis, since no adult language blurs the distinction between the two arguments of the universal quantifier. Thus, the aim of the present study is to further investigate the Continuity Hypothesis, by exploring children's knowledge of one semantic property that distinguishes between the two arguments of the universal quantifier.

3.   Concerns with the Partial Competence View

The need for a grammatical explanation of children's responses to sentences containing the universal quantifier *every* was questioned by Crain, Thornton, Boster, Conway, Lillo-Martin and Woodams (1996). These researchers proposed what can be called the Full Competence view.[4] The Full Competence view presents both empirical and theoretical arguments against the Partial Competence view. We focus first on four theoretical drawbacks that were levied against the Event Quantification account of children's non-adult behavior (see Crain at al. (1996) for further discussion). The same arguments carry over to the Weak Quantification account. First, according to both of these variants of the Partial Competence view, the universal quantifier, a determiner, violates a putative universal constraint on the interpretation of determiners. The universal principle at issue is the *conservativity* of determiner meanings (e.g., Barwise and Cooper, 1981). According to the Event Quantification account, for example, *every* can assume the meaning of *equinumerous* for children; but this meaning violates conservativity. A second concern with these accounts is that they violate compositionality, as discussed in the previous section. A third strike against such accounts is that they run contrary to the Continuity Assumption, which states that child language can differ from the local language only in ways that adult languages can differ from each other. The Continuity Assumption is flouted on these accounts because there is no known adult

---

[4] See also Freeman, Sinha and Stedmon (1982).

language that analyzes the universal quantifier in the manner attributed to children. Finally, these accounts face a learnability problem. The problem of learnability arises because, as we have seen, children have access to two semantic representations for sentences with the universal quantifier, including the semantic representation that is available to adults. This means that all of the input from adults will be consistent with children's grammar. Moreover, children's productions of sentences containing the universal quantifier will be acceptable to adults, since the interpretation exclusive to children's grammar is more restrictive than the adult interpretation. Therefore, it is difficult to see how children will ever be compelled to abandon their non-adult analysis, to converge on the target grammar.

In addition to these theoretical misgivings, Crain et al. pointed out a potential flaw in the design of the experiments that evoked non-adult responses from children, and they demonstrated that children's performance dramatically improves if the experiment is modified appropriately. Crain et al. argue that the improvement in children's performance results from satisfying certain felicity conditions that are associated with judgments of truth or falsity (as in answering Yes/No questions). More specifically, Crain et al. (1996) attribute children's consistent adult-like performance to the satisfaction of the 'condition of plausible dissent.' Essentially, the point of plausible dissent was made by Bertrand Russell (1948, p. 138) who stated that "perception only gives rise to a negative judgment when the correlative positive judgment has already been made or considered". According to the condition of plausible dissent, a negative answer to the question in (1) would be felicitous if, for example, every boy in the conversational context considered riding an elephant, but some boy(s) decided to ride something else, say a dinosaur. Similarly, Crain et al. argue that an affirmative answer would be felicitous if some boy(s) considered riding a dinosaur but, in the end, every boy decided to ride an elephant. In such circumstances, children were shown to consistently produce affirmative responses to (1), just like adults do.

The contrast between the Partial Competence view advanced by Philip (1995; 1996) and Drozd and van Loosbroek (1998) and the Full Competence view advanced by Crain et al. (1996) has received considerable attention in the literature (see Gordon, 1996; Geurts, 2001). Most of the research has focused on the felicity condition proposed by Crain et al. (1996) and on alternative explanations of children's improved performance in the Truth Value Judgment task. Although we believe that features of experimental design should not be downplayed, we will take another tack in this paper, drawing upon linguistic theory to adjudicate between the Partial Competence view and the Full Competence view. The linguistic property that will be put to use is that of downward entailment.

4.   Downward Entailment in Adult and Child Language

Downward entailing operators manifest consistent distributional and interpretive consequences for sentences that contain them. The defining property of downward entailment is the licensing of inferences from sets to their subsets. As shown in (9), negation satisfies this property. In particular, a sentence containing a noun phrase (e.g., *pizza*) within the scope of negation entails any sentence in which that noun phrase is replaced by one that picks out a subset of the original set (e.g., *pepperoni pizza*).

(9)   John did not eat pizza $\Rightarrow$ John did not eat pepperoni pizza.

As the invalidity of the inference in (10) shows, ordinary positive statements do *not* license inferences from a set to its subsets; i.e., they are not downward entailing.

(10)   John ate pizza $*\Rightarrow$ John ate pepperoni pizza.[5]

A second property of downward entailment pertains to the distribution of negative polarity items, e.g., *any* and *ever* in English (cf. Ladusaw, 1979; Linebarger, 1987). As shown by the grammaticality of the sentences in (11), negative polarity items (NPIs) are permitted in the scope of negation, but they are not tolerated in ordinary affirmative statements, as indicated in (12).

(11)   a.   John did not eat any pizza.

         b.   John has not ever eaten pizza.

(12)   a.   *John ate any pizza.

         b.   *John has ever eaten pizza.

A third property of downward entailing operators concerns the interpretation of disjunction. For any downward entailing (DE) operator, a statement containing disjunction in the scope of that operator is logically equivalent to statements containing conjunction taking scope over the same operator, according to the schema in (13) (see e.g., Boster and Crain, 1993).[6] This schema is a generalization of (one direction of) one of the De Morgan's laws of propositional logic (see e.g., Partee, ter Meulen and Wall, 1990).

(13) $OP_{DE}(A \text{ or } B) \Rightarrow OP_{DE}(A) \text{ and } OP_{DE}(B)$.

(14) $\neg(P \vee Q) \Leftrightarrow \neg P \wedge \neg Q$.

The application of the inference scheme in (13) is exemplified in ordinary language in (15). As (16) shows, the same inference fails to apply in affirmative contexts.

(15)   John did not eat pepperoni or cheese pizza

         $\Leftrightarrow$ John did not eat pepperoni pizza and he did not eat cheese pizza.

(16)   John ate pepperoni or cheese pizza

         $*\Leftrightarrow$ John ate pepperoni pizza and she ate cheese pizza.

The semantic consequences of downward entailment have been investigated by Gualmini and Crain (2001; 2002) using a Truth Value Judgment task. The Truth Value Judgment task is an experimental technique that allows an experimenter to investigate whether a specific interpretation of a target sentence is licensed by the child's grammar (Crain and McKee,

---

[5] We will use the symbols '$*\Rightarrow$' and '$*\Leftrightarrow$' to indicate invalid implications and invalid equivalences respectively.
[6] This phenomenon is referred to as conjunctive interpretation by Higginbotham (1991).

1985; Crain and Thornton, 1998). In the task, one experimenter acts out a short story in front of the child using props and toys. The story constitutes the context against which the target sentence is evaluated by the child. Following each story, a test sentence is presented by a puppet, which is manipulated by a second experimenter. Children's acceptance of the test sentence is interpreted as evidence that they access an interpretation that makes the sentence true in the context under consideration. By contrast, children's consistent rejection of the test sentence is evidence that their grammars do not license an interpretation that makes the sentence true in that context.

Gualmini and Crain used the Truth Value Judgment task to investigate children's knowledge of the inference scheme typical of downward entailing operators. These authors investigated children's interpretation of the disjunction operator *or* in the nuclear scope of the quantificational phrase *None of the Ns*, a downward entailing linguistic environment. As (17) shows, the interpretation of disjunction in the nuclear scope of *None of the Ns* yields a conjunctive interpretation.

(17)   None of the students in this class speaks French or Spanish

⇔   None of the students in this class speaks French and none of the students in this class speaks Spanish.

To find out whether children know this property, children were asked to evaluate sentences like (18) in a context in which one of three pirates had found a jewel they had all been searching for, but none of them had found the necklace.

(18)   None of the pirates found the necklace or the jewel.

The child subjects interviewed in the Gualmini and Crain study consistently rejected the test sentences; in the context under consideration children pointed out that the puppet was wrong because one of the pirates had found the jewel. The experimental findings reveal the possibility of using the Truth Value Judgment task to study children's knowledge of entailment relations. This motivated us to design a study using the Truth Value Judgment task to assess children's knowledge of downward entailment in sentences that contain the universal quantifier.

5.   The Universal Asymmetry

As we noted earlier, the Partial Competence view of children's non-adult responses blurs the distinction between the internal argument (restrictor) and the external argument (nuclear scope) of the universal quantifier. One relevant semantic property that can be used to assess children's adherence to the Partial Competence view is downward entailment, because the universal quantifier is downward entailing on its internal argument, but not on its external argument. To see this, let us rehearse the properties of downward entailing environments. First, the internal argument of *every* licenses inferences from a set to its subsets (as long as the relevant presupposition of existence is satisfied); the external argument does not.

(19)   Every boy who ate pizza got sick

⇒ Every boy who ate pepperoni pizza got sick.

(20)   Every boy ate pizza *⇒ Every boy ate pepperoni pizza.

Second, the internal argument licenses the occurrence of NPIs like *any* or *ever*, but the external argument does not:

(21)   a. Every boy who ate any pizza got sick.

        b. Every boy who ever ate pizza got sick.

(22)   a. *Every boy ate any pizza.

        b. *Every boy ever ate pizza.

Finally, the internal argument of the universal quantifier *every* enforces the conjunctive interpretation of the disjunction operator *or*, but the external argument does not require this interpretation; the external argument licenses the exclusive-*or* interpretation of disjunction, as illustrated in (24).

(23)   Every boy who ate cheese pizza or pepperoni pizza got sick.

        ⇔   Every boy who ate cheese pizza got sick and every boy who ate pepperoni
               pizza got sick.

(24)   Every boy ate cheese pizza or pepperoni pizza.

        *⇔   Every boy ate cheese pizza and every boy ate pepperoni pizza.

These asymmetries in the two arguments of *every* constitute an interesting domain of research in child language. This research assumes special relevance in assessing the grammatical accounts of children's non-adult responses to sentences containing the universal quantifier. As we saw in Section 1, a common assumption of these accounts is that children experience difficulty in mapping the syntax of sentences containing the universal quantifier onto the semantic representation. A prediction of this view, then, is that children should not show early mastery of the properties exemplified in (19) through (24). In order to evaluate this prediction, two aspects of children's knowledge need to be assessed. First, we must see if children know that the internal argument of the universal quantifier *every* constitutes a downward entailing environment. Second, we must see if children know that the external argument of the universal quantifier *every* does not constitute a downward entailing environment.

The logical properties of the external argument of the universal quantifier *every* were investigated by Boster and Crain (1993). The Boster and Crain study asked whether or not children would extend the application of one of the De Morgan's laws to *non*-DE environments. To address this question, Boster and Crain (1993) designed a Truth Value

Judgment task in which children were asked to evaluate sentences like (25) in various scenarios. [7]

(25)   Every ghostbuster will choose a cat or a pig.

The results obtained by Boster and Crain (1993) provide evidence that children assign the exclusive interpretation to the disjunction operator *or,* when it appears in the external argument of *every*. That is, children do not treat the nuclear scope of the universal quantifier *every* as downward entailing. In other words, children do not assign a conjunctive interpretation to (25) as in (26).

(26)   Every ghostbuster will choose a cat and every ghostbuster will choose a pig.

The experimental findings show that children do not extend the pattern of inference that characterizes downward entailing environments to *non*-DE environments.

It is pertinent to observe that Boster and Crain (1993) discovered some non-adult behavior in children's interpretation of the sentences under investigation. In particular, children generally accepted (25) in a context in which every ghostbuster had chosen exactly one object. However, almost every child imposed an additional restriction on the interpretation of (25). One group of children expected the kind of animal chosen by the ghostbuster to be the same for all ghostbusters, and a second group of children expected the kind of animal chosen by the ghostbuster *not* to be the same for all ghostbusters. We will not focus on the source of these mistakes, but we would like to emphasize that, despite some non-adult behavior, children never applied the inference scheme typical of downward entailing environment to the external argument of the universal quantifier.

The study by Boster and Crain (1993) did not attempt to determine whether children would correctly interpret the disjunction operator *or* in the internal argument of the universal quantifier *every*. The Boster and Crain study simply invites us to infer that children have an adult-like interpretation of the disjunction operator *or* in the external argument of the universal quantifier. No inference can be drawn, however, about children's knowledge of the difference between the two arguments. To fill this gap, we designed an experiment to determine whether children correctly assign a conjunctive interpretation to the disjunction operator *or* in the internal argument of the universal quantifier.

6.   The Experiment: Disjunction in the Internal Argument of *Every*

We conducted a Truth Value Judgment task to determine whether children correctly interpret the disjunction operator *or* in accordance with the inference scheme typical of downward entailment. Twenty children participated in the experiment. The children's age ranged from 3;11 to 5;09 and the mean age was: 5;1. We illustrate the experimental design using a typical trial in (27).

---

[7] The study by Boster and Crain (1993) presented sentences as predictions. This variant of the Truth Value Judgment task is called Prediction Mode and was designed by Chierchia, Crain, Guasti and Thornton (1998). The Prediction Mode differs from the standard Truth Value Judgment task in that the test sentence is presented to the child before the completion of the story, as a prediction about what will happen in the remainder of the story. Since the target sentence is presented before the hearer has all the necessary information to evaluate its truth or falsity, the Prediction Mode can be used to cancel scalar implicatures which could otherwise arise for the test sentences that contain, e.g., the disjunction operator *or* (see Grice, 1975).

(27)   This is a story about five trolls who go to the fast food owned by Genie. The Trolls order food. One troll gets a big hot-dog, two trolls order onion rings and two trolls order French fries. Genie serves all the food and asks the trolls whether they need anything else. The Troll who ordered the hot-dog says he does not need anything else. The two trolls who ordered French fries ask for mustard, and Genie gives a big bottle of mustard to each of them, The two trolls who ordered onion rings also ask for mustard. Genie says: "I am sorry, but I do not have any more regular mustard. I have this special super-hot and super-spicy mustard though" and shows the trolls two big bottles of a different kind of mustard. The Trolls say they don't like spicy mustard, even less so super-spicy mustard and ask Genie some ketchup. Genie brings them two bottles of ketchup and says: "I'll keep the super-spicy mustard for myself!".

At this point children were presented with the sentence in (28).

(28)   This was a story about some trolls at Genie's restaurant and I know what happened. <u>Every troll who ordered French fries or onion rings got some mustard.</u>

Notice that the target sentence receives a different truth value depending on whether the disjunction operator *or* is interpreted in accordance with the inference scheme typical of downward entailing environments, as in (29), or in accordance with the inference scheme typical of non-downward entailing environments, as in (30).

(29)   Every troll who ordered French fries got some mustard and every troll who ordered onion rings got some mustard.

(30)   Every troll who ordered French fries got some mustard or every troll who ordered onion rings got some mustard.

In particular, the adult interpretation of the target sentence (i.e., (29)) makes the sentence false in the scenario, while the non-adult interpretation that could be constructed on the basis of non-downward entailing environments (i.e., (30)) makes the sentence true. Each child was presented with four target trials interspersed with an equal number of filler trials. Among the target trials, two were false because of the second disjunct, and two were false because of the first disjunct. Here are the results. Children correctly rejected the target sentences 95% of the time (on 76 out of 80 trials). A control group of fourteen adults rejected the target sentences 84% of the time (on 47 out of 56 trials).

The experimental findings show that children, like adults, interpret the disjunction operator *or* in the internal argument of the universal quantifier *every* in accordance with the inference scheme typical of downward entailing operators. Taken together with the results of Boster and Crain (1993), the findings reveal a striking asymmetry between children's interpretation of the disjunction operator *or* in the two arguments of the universal quantifier. This asymmetry reflects children's knowledge of the difference between the two arguments of the universal quantifier *every*. This finding is mysterious on the grammatical accounts of children's interpretation of the universal quantifier.

An independent set of experiments on children's knowledge of information strength also suggests that children distinguish between the two arguments of the universal quantifier *every*. Gualmini, Crain, Meroni, Chierchia and Guasti (2001) tested children's understanding of information strength in the two arguments of the universal quantifier *every* using a Felicity Judgment task. In this task, children are presented with alternative descriptions, produced by two different puppets. In one experiment, children were asked to choose between the descriptions in (31), in a context in which every farmer had cleaned both a horse and a rabbit.

(31)   a.   Every farmer cleaned a horse or a rabbit.

      b.   Every farmer cleaned a horse and a rabbit.

The finding was that children consistently rewarded the puppet who provided the description in (31)b, which is the most informative statement.

In a second experiment, children were told a story about the Easter Bunny who had given a bottle of water to five girls. Of the five girls, three had picked both a turtle and a bunch of flowers, one had picked only a turtle, and one only a bunch of flowers. There was a sixth girl, who picked a teddy bear, but she was not given a bottle of water. Children were asked to choose between the following descriptions of the story:

(32)   a.   Every girl who picked a turtle or a bunch of flowers received a bottle of water.

      b.   Every girl who picked a turtle and a bunch of flowers received a bottle of water.

In this condition, children consistently rewarded the puppet who had used the disjunction operator *or* (i.e., (32)a). The results suggest that children's use of information strength reflects the different entailment properties of the two arguments of the universal quantifier *every*. Again, the findings resist explanation on the Partial Competence account of children's interpretation of the universal quantifier.

7.   Conclusion

In the past few years research has focused on various aspects of children's semantic competence, including downward entailment and quantification. The present study pulls these two lines of research together, using children's interpretation of the disjunction operator *or* as a yardstick of their knowledge of downward entailment. This, in turn, can be viewed as a measure of children's knowledge of quantification. In this paper we have argued that children's mastery of downward entailment extends to one of its most interesting features, namely the asymmetry between the two arguments of the universal quantifier. The findings of these experimental investigations are not surprising if one adopts the Full Competence view defended by Crain et al. (1996), but they are not anticipated on the view that children experience difficulties in the mapping between the syntactic form and the semantic representation of sentences containing the universal quantifier.

References

Barwise, John and Robin Cooper (1981) "Generalized quantifiers and natural language." *Linguistics and Philosophy*, 4, 159-219.

Boster, Carole and Stephen Crain (1993) "On Children's Understanding of *Every* and *Or*." In *Proceedings of Early Cognition and Transition to Language*, University of Texas at Austin.

Crain, Stephen (2000) "Sense and sense ability in child language." In *Proceedings of the 24th Boston University Conference on Language Development*, 22-44. Somerville: Cascadilla Press.

Chierchia, Gennaro, Stephen Crain, Maria Teresa Guasti, and Rosalind Thornton (1998) "'Some' and 'or': A study on the emergence of Logical Form." In *Proceedings of the 22nd Boston University Conference on Language Development*, 97-108. Somerville, MA: Cascadilla Press.

Crain, Stephen, and Cecile McKee (1985) "The acquisition of structural restrictions on anaphora." In *Proceedings of NELS 15*, 94-110. Amherst, MA: GLSA.

Crain, Stephen, and Rosalind Thornton (1998) *Investigations in Universal Grammar.* Cambridge, Mass: MIT Press

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

Drozd, Kenneth, and Erik van Loosbroek (1998) "Weak quantification, plausible dissent, and the development of children's pragmatic competence." In *Proceedings of the 23rd Boston University Conference on Language Development,* 184-195. Somerville, MA: Cascadilla Press.

Drozd, Kenneth, and Erik van Loosbroek (1999) *The effect of context on children's interpretation of universally quantified sentences.* Ms., Max Planck Institute for Psycholinguistics and Nijmegen University, Nijmegen.

Freeman, Norman H., C.G. Sinha and Jacqueline A. Stedmon (1982) "All the cars –which cars? From word to meaning to discourse analysis." In Michael Beveridge (Ed.) *Children thinking through language*, 52-74. London: Edward Arnold Publisher.

Geurts, Bart (2001) *Quantifying Kids*. Ms., Humboldt University, Berlin and University of Nijmegen, Nijmegen.

Gordon, Peter (1996) "The Truth Value Judgment Task." In *Methods for Assessing Children's Syntax,* Dana McDaniel, Cecile McKee and Helen Smith Cairns (Eds.), 211-231. Cambridge, MA: MIT Press.

Gualmini, Andrea and Stephen Crain (2001). "Downward Entailment in Child Language." In *University of Maryland Working Papers in Linguistics*, *11*, 112-133, University of Maryland at College Park.

Gualmini, Andrea, Stephen Crain, Luisa Meroni, Gennaro Chierchia and Maria Teresa Guasti (2001) "At the Semantics/Pragmatics Interface in Child Language." In *Proceedings of Semantics and Linguistic Theory 11*, 231-247. Ithaca, NY: Cornell University.

Gualmini, Andrea and Stephen Crain (2002) "Why No Child or Adult Must Learn De Morgan's Laws." In *Proceedings of the 26th Boston University Conference on Language Development*, 243-254. Somerville, MA: Cascadilla Press.

Heim, Irene (1982) *The Semantics of Definite and Indefinite Noun Phrases.* Doctoral dissertation, University of Massachusetts, Amherst, MA.

Higginbotham, James (1991) "Either/Or." In *Proceedings of NELS*, 21, 143-155. Amherst, MA: GLSA.

Inhelder, Barbel and Jean Piaget (1964) *The early growth of logic in the child.* London: Routledge, Kegan and Paul.

Ladusaw, William (1979) *Negative Polarity Items as Inherent Scope Relations*. Unpublished Ph.D. Dissertation, University of Texas at Austin.

Linebarger, Marcia (1987) "Negative Polarity and Grammatical Representation." *Linguistics and Philosophy*, 10, 325-387.

May, Robert (1977) *The Grammar of Quantification*. Doctoral dissertation, Massachusetts Institute of Technology, Cambridge, MA.

Meroni, Luisa, Andrea Gualmini and Stephen Crain (2000) "A conservative approach to quantification in child language." In *Proceedings of the 24th Annual Penn Linguistics Colloquium*, 171-182. Philadelphia, PA: UPenn.

Meroni, Luisa, Stephen Crain and Andrea Gualmini (2001) "Felicity Conditions and On-line Interpretation of Sentences with Quantified NPs", paper presented at the *14th Annual CUNY Conference on Human Sentence Processing*, March 15th-17th, 2001. Philadelphia, University of Pennsylvania.

Philip, William (1995) *Event quantification in the acquisition of universal quantification*. Doctoral dissertation, University of Massachusetts, Amherst.

Philip, William (1996) "The Event Quantificational Account of Symmetrical Interpretation and a Denial of Implausible Infelicity." In *Proceedings of the 20th Boston University Conference on Language Development,* 564-575. Somerville, MA: Cascadilla Press.

Russell, Bertrand (1948) *Human knowledge: Its scope and limits*. London: Allen.