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SQUIBS AND REPLIES

The Scope of Isomorphism: Turning Adults Into Children

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1. INTRODUCTION

In this article, we investigate the roots of a phenomenon that has been recently reported to manifest itself in children's interpretation of ambiguous sentences containing negation (Neg) and quantified noun phrases (NPs) (Lidz and Musolino (2002), Musolino (1998), Musolino, Crain, and Thornton (2000), Musolino and Lidz (2003)). The phenomenon in question, known as the "isomorphism effect," expresses the observation that young children, unlike adults, display a strong preference for the interpretation of ambiguous sentences containing multiple quantificational elements that corresponds to the surface syntactic position of these elements.

In the case of ambiguous sentences such as *Every horse didn't jump over the fence,* for example, it has been observed that preschool children and adults have opposite interpretive preferences (Musolino (1998), Musolino et al. (2000), Musolino and Lidz (2003)). That is, whereas adults display a strong preference for the interpretation on which Neg takes scope over the universally quantified subject (i.e., *not* > *every*), preschoolers systematically interpret the quantified subject as taking scope over Neg (i.e., *every* > *not*). Such findings raise a number of interesting questions. An important question is developmental and asks how children manage to reverse their preferences in the course of language development. The

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answer to this question, in turn, has implications for theories of the development of sentence processing abilities (Trueswell, Sekerina, Hilland, and Logrip (1999). For a detailed proposal, see Musolino and Lidz (2003)).

In this article, we focus on the isomorphism effect as it pertains to sentences containing negation and numerally quantified expressions, for example, *Donald didn't find two friends.* We demonstrate that in this case, the isomorphism effect does not reflect children's and adults' opposite preferences; rather, we show that the effect observed in children represents an exaggerated interpretive preference also observable in adults. Furthermore, we demonstrate that under certain conditions, adults can be "turned into children" and also display the isomorphism effect seen in children. Finally, we show that the same contextual factors that enable children to override their isomorphic preferences (see Musolino and Lidz (2003)) have a similar effect on adults, now turned into children (for a similar approach, see Freeman, Sinha, and Stedmon (1982)).

We conclude that these results lend support to the emerging view (see Musolino and Lidz (2003) and also Gualmini (in press)) that children's isomorphic interpretations reflect differences between children and adults in the operation of the parser rather than differences between children's emerging grammatical systems and those of mature speakers. More importantly, however, we show that these findings have implications for recent theorizing concerning the development of sentence processing abilities in young children (Trueswell et al. (1999)). Specifically, these results underscore the fact that although children's and adults' sentence processing abilities may differ quantitatively, they do not differ qualitatively—at least within the confines of the phenomena under investigation—thereby lending support to the Continuity Assumption (Pinker (1984)).

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2. CHILDREN'S INTERPRETATION OF SCOPE RELATIONS

Lidz and Musolino (2002) investigated the way children (and adults) interpret scopally ambiguous sentences containing numerally quantified NPs and Neg (1):

(1) Donald didn't find two friends.

On one interpretation, (1) can be paraphrased as *It is not the case that Donald found two friends.* In this case, the NP *two friends* is interpreted within the scope of Neg (abbreviated *not* > *two*). This is what Lidz and Musolino called an "isomorphic" interpretation because in this case, the scope relation between Neg and the NP *two friends* can be directly read off their surface syntactic position. Alternatively, (1) can be paraphrased as *There are two friends that Donald didn't find.* Here, *two friends* is interpreted outside the scope of Neg (abbreviated *two* > *not*). This is what Lidz and Musolino called a "non-isomorphic" interpretation because

in this case, the scope relation between Neg and *two friends* is the reverse of what is given by the surface syntax. Lidz and Musolino's main finding is that when given a Truth Value Judgment Task (TVJT), adults can easily access either scope interpretation of sentences such as (1), whereas 4-year-old children display a strong preference for the isomorphic interpretation (crucially, however, Lidz and Musolino showed that children's preferences are constrained by the surface c-command relations between the quantificational elements and not by their linear order).

In related work, Musolino and Lidz (2003), following Musolino (1998) and Musolino et al. (2000), investigated children's interpretation of ambiguous sentences such as (2):

(2) Every horse didn't jump over the fence.

As in the case of (1), example (2) can receive either an isomorphic interpretation (abbreviated *every* > *not*) on which the sentence may be paraphrased as *Every horse is such that it didn't jump over the fence* (i.e., none of the horses jumped over the fence) or a nonisomorphic interpretation (abbreviated *not* > *every*) on which the sentence can be paraphrased as *Not every horse jumped over the fence.* The relevant finding here is that children and adults display opposite preferences regarding the interpretation of sentences such as (2). Specifically, Musolino (1998) and Musolino et al. (2000) found that whereas adults have a strong preference for the nonisomorphic interpretation (in both comprehension and production), young children display a strong preference for the isomorphic interpretation. However, Musolino and Lidz (2003), who replicated this finding, also showed that children's ability to access the nonisomorphic interpretation of sentences like (2) dramatically improves when such sentences are preceded by an affirmative statement, as shown in (3):[1]

(3) Every horse jumped over the log and/but every horse didn't jump over the fence.

The recent findings regarding children and adults' interpretation of sentences such as (2) raise interesting questions for the observation of isomorphism as it pertains to sentences such as (1): Do children and adults also have opposite preferences in the case of sentences such as (1) or does children's preference for the isomorphic reading reflect an exaggerated preference also observable in adults? From a developmental perspective, this question is important because it directly bears on the nature of the mechanisms involved in children's transition to the adult system.

[1]Notice that this result obtains regardless of whether *and* or *but* is used in sentences such as *Every horse jumped over the log but/and every horse didn't jump over the fence.*

To the extent that children's isomorphic behavior in the case of (1) represents an exaggerated manifestation of an interpretive preference also observable in adults, one would predict that it may be possible to induce the isomorphism effect in adults as well. Assuming that this can be achieved, it would also be interesting to determine whether the same contextual factors that allow children to override their isomorphic tendencies would have a similar effect on adults.

In this article, we address these questions and show that in the case of (1), children's overly isomorphic interpretations do indeed reflect an exaggerated interpretive preference also observable in adults. Furthermore, we demonstrate that under certain conditions, adults can be turned into children and display the isomorphism effect. Finally, we show that the same contextual factors that enable children to override their isomorphic preferences also have a similar effect on adults.

3. EXPERIMENT 1

We tested adults' interpretation of ambiguous sentences like (4).

(4) Cookie Monster® didn't eat two slices of pizza.

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Lidz and Musolino (2002) showed that when presented with contexts in which either reading of (4) is true (whereas the other is false), adult speakers of English (and Kannada) almost always judge the sentences to be true. By contrast, 4-year-old speakers of English and Kannada accept these sentences much less often in contexts in which the wide scope reading of the object is true and the narrow scope reading is false. Although these results clearly indicate that children have a preference for the narrow scope interpretation, they suggest that adults, when placed in the same experimental situation as children, do not display any preferences. However, this does not necessarily mean that adults do not have a preference. One way to find out would be to place adults in a situation in which both readings of sentences such as (4) are true and ask them to explain why they think that the sentences are true. It seems reasonable to conclude that the reading participants would invoke to justify their (necessarily) positive answers, that is, the wide scope or the narrow scope reading, corresponds to their preferred interpretation.

3.1. Participants

We tested 10 adult native speakers of English, all of whom were undergraduate students at Indiana University.

3.2. Procedure and Materials

We tested participants' interpretation of sentences such as (4) using the same experimental methodology as the one used in Lidz and Musolino (2002), namely, the TVJT (Crain and Thornton (1998)). The materials used were identical to the materials used by Lidz and Musolino (2002).[2] The only difference is that, in each of the critical stories, both scope readings of the object were true. So, for example, in the story corresponding to the statement *Cookie Monster didn't eat two slices of pizza,* Cookie Monster was given three slices of pizza, ate only one of them (i.e., *not* > *two* = true), and failed to eat the other two (i.e., *two* > *not* = true); see Figure 1. See Table 1 for the complete list of statements. In addition to test stories, adults

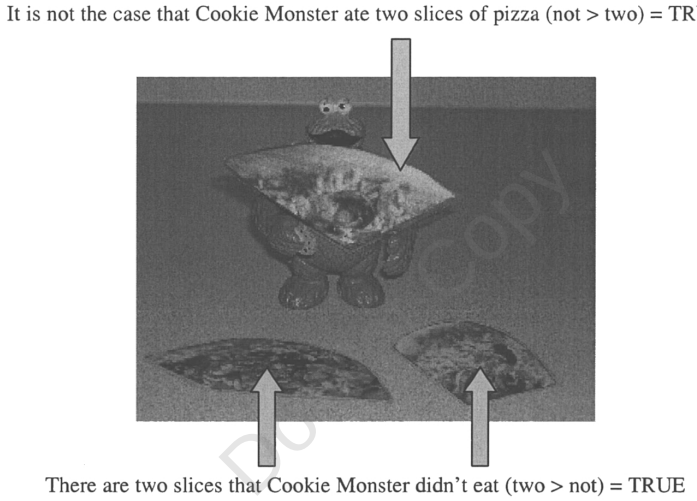

FIGURE 1 Cookie Monster didn't eat two slices of pizza.

TABLE 1
Puppet Statements on Critical Trials, Experiment 1

Puppet Statements on Critical Trials	
Test Story	*Statement*
1	Cookie Monster didn't eat two slices of pizza
2	The caveman didn't ride two horses
3	The boy didn't pet two animals
4	Goofy didn't find two friends

[2]In all the experiments reported in this study, adult participants were presented with video recordings of the stories, including recordings of the statements made by the puppet.

also heard warm-up and control stories. Because adults always behaved perfectly on warm-ups and controls, we only report their performance on critical trials. See Lidz and Musolino (2002) for a complete description of the procedure.

3.3. Results and Discussion

Not surprisingly, we found that adults accepted the puppet's statements 100% of the time. Participants' justifications were coded as either "wide scope," in case participants clearly invoked the wide scope reading as their reason for accepting the sentence (e.g., the puppet is right because there are two slices of pizza that Cookie Monster didn't eat), and "narrow scope," for example, Cookie Monster only ate one slice (i.e., *not > two*) or "unclear" if the justification did not allow us to unambiguously decide between a wide scope or a narrow scope answer. We found that 75% of the participants' justifications were of the narrow scope kind, 7.5% were wide scope answers, and 17.5% were unclear answers. Specifically, 7 participants gave narrow scope justifications four times out of four, 1 participant gave two narrow scope justifications and two unclear answers, 1 participant gave one wide scope justification and three unclear answers, and 1 participant gave three wide scope justifications and one unclear answer. This pattern of responses is significantly different from what would be expected by chance, $\chi^2(1, N = 40) = 10$, $p < .01$.[3] The results thus indicate that adults have a clear preference for the narrow scope reading of sentences such as *NP didn't V two N*.

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4. EXPERIMENT 2

The results of Experiment 1 suggest that children's preference for the narrow scope reading of sentences such as *NP didn't V two N* reflect an exaggerated preference also observable in adults. Given this finding, we now ask whether the isomorphism effect seen in children can also be induced in adults. To address this question, we considered sentences containing a numerally quantified subject and negation, as in (5).

(5) Two frogs didn't jump over the rock.

This experimental manipulation is based on the following intuition. Whereas (5) is in principle ambiguous between a wide scope and a narrow scope reading, it seems to us that the narrow scope reading, on which the sentence can be para-

[3]To test our hypothesis under the most stringent conditions, we assumed that all the unclear justifications were in fact wide scope justifications. If so, 75% of the justifications are of narrow scope type (i.e., 30 of 40), and 25% of them would be of wide scope type (i.e., 10 of 40). We then tested this observed pattern against what would be expected by chance.

phrased as *It is not the case that two frogs jumped over the rock,* is much harder to obtain than the wide scope reading (i.e., two frogs are such that they didn't jump over the rock), perhaps due to the fact that subjects tend to be interpreted as topics and hence require a wide scope interpretation.

4.1. Participants

We tested 20 adult native speakers of English. The participants were all undergraduate students at Indiana University.

4.2. Procedure and Materials

As in Experiment 1, we used the TVJT. Participants were randomly assigned to either of two conditions (see Lidz and Musolino (2002)). In Condition 1, sentences such as (5) were true on the wide scope reading of the numeral and false on the narrow scope reading. So, for example, four frogs decide to jump over a rock and two end up jumping whereas the other two end up not jumping. So in the end, it is true that there are two frogs that did not jump, whereas it is false that it is not the case that two frogs jumped because (exactly) two frogs jumped: see Figure 2. In Condition 2, the pattern is reversed. That is, the wide scope reading is false and the narrow scope reading is true. This is achieved by having two frogs attempting to jump over a rock. One ends up jumping and the other one does not. So in the end, it is false that there are two frogs that didn't jump over the rock (i.e., only one

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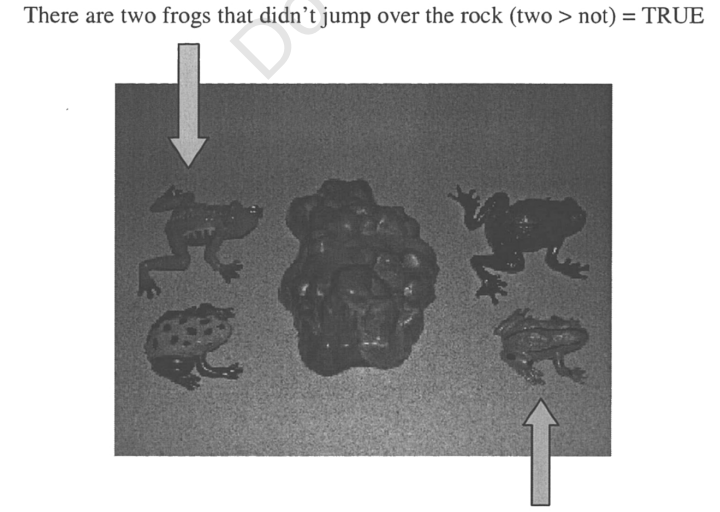

FIGURE 2 Two frogs didn't jump over the rock (condition 1).

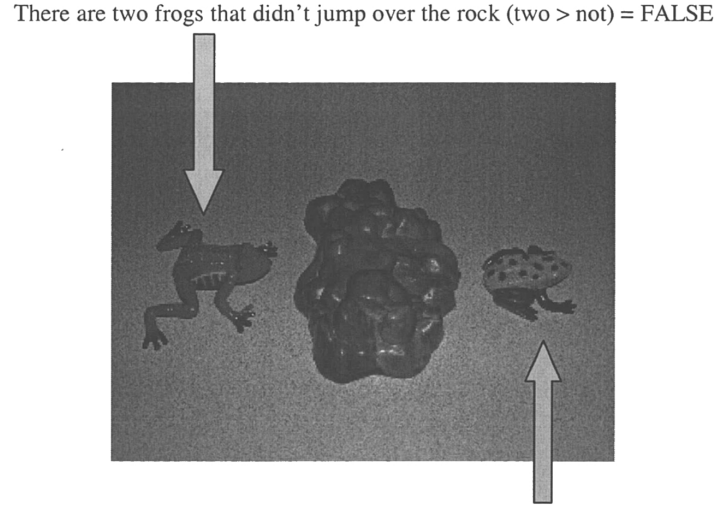

FIGURE 3 Two frogs didn't jump over the rock (condition 2).

TABLE 2
Puppet Statements on Critical Trials, Experiment 2

Puppet Statements on Critical Trials	
Story	*Statement*
1	Two frogs didn't jump over the rock
2	Two butterflies didn't go to the city
3	Two lions didn't buy a cookie
4	Two dinosaurs didn't eat fish

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frog didn't jump over the rock), whereas it is indeed not the case that two frogs jumped over the rock (i.e., only one frog jumped over the rock); see Figure 3. The complete list of critical statements is given in Table 2.

4.3. Results and Discussion

In the analysis that follows, our dependent measure is the proportion of *yes* responses to the puppet statements. We found that although adults accepted the puppet statements 100% of the time in the condition in which the wide scope reading was true, their acceptance rate was only 27.5% in the condition in which the narrow scope reading was true, $t(18) = 6.32$, $p < .0001$. Turning to justifications, we found that when adults rejected the puppet's statements, they always invoked the

fact that the wide scope reading of the sentences was false. Thus, the isomorphism effect can also be observed in adults.

5. EXPERIMENT 3

Next, we tried to determine whether the same contextual factors that have been shown to help children override their isomorphic bias would have a similar effect on adults. In the psycholinguistics literature, it has been claimed that negative statements are easier to process when they are preceded by affirmative statements (Wason (1965)). Based on this observation, Musolino and Lidz (2003) showed that children's adult-like interpretation of sentences such as *Every horse didn't jump over the fence* was greatly facilitated in the presence of preceding affirmative statements, as in *Every horse jumped over the log but/and every horse didn't jump over the fence.* To determine whether the presence of affirmative statements would also have a similar effect on adults' overisomorphic interpretation of sentences such as (5), we decided to test adults on their interpretation of sentences such as (6).

(6) Two frogs jumped over the fence but two frogs didn't jump over the rock.

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5.1. Participants

We tested 20 adult native speakers of English. The participants were all undergraduate students at Indiana University or Northwestern University. The students at Northwestern University received course credit for their participation.

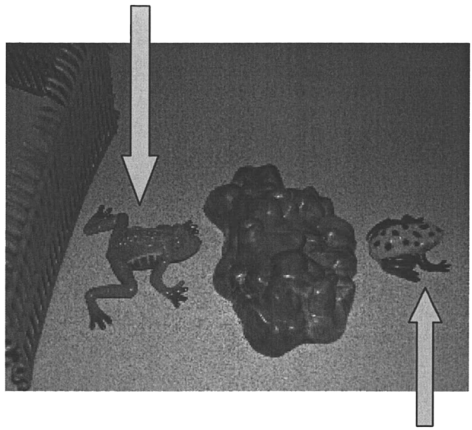
5.2. Materials and Procedure

As before, we used the TVJT. The material and procedure used in Experiment 3 are identical to those used in Experiment 2 except that the puppet's statements are now all preceded by affirmative statements, that is, (6). Participants were randomly assigned to two conditions. Condition 1 was intended to replicate the results of Experiment 2 and therefore used the same materials as those used in Experiment 2. In Condition 2, the stories were slightly modified to now be used with statements such as (6); see Figure 4. The complete list of critical statements for Condition 2 is given in Table 3.

5.3. Results and Discussion

We found that in Condition 1, adults only accepted the puppet's statements 27.5% of the time—thereby replicating the results of Experiment 2—whereas in Condition 2, their acceptance rate increased dramatically, that is, 92.5%, $t(18) = 4.29$, p

Two frogs jumped over the fence but there are two frogs that didn't jump over the rock
(two > not) = FALSE



Two frogs jumped over the fence but it is not the case that two frogs jumped over the rock (not > two) = TRUE

FIGURE 4 Two frogs jumped over the fence but two frogs didn't jump over the rock.

TABLE 3
Puppet Statements on Critical Trials, Experiment 3

Puppet Statements on Critical Trials	
Story	*Statement*
1	Two frogs jumped over the fence but two frogs didn't jump over the rock
2	Two butterflies went to the forest but two butterflies didn't go to the city
3	Two lions bought an egg but two lions didn't buy a cookie
4	Two dinosaurs ate a bug but two dinosaurs didn't eat fish

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< .001. This result demonstrates that the same kind of contextual factors—in this case the presence of an affirmative statement preceding the negative sentence—which have been shown to help children overcome their isomorphic bias (Musolino and Lidz (2003)) also have a similar effect on adults, now turned into children.

6. CONCLUDING REMARKS

The results presented here have two main implications. First, they lend support to the emerging view (see Musolino and Lidz (2003) and also Gualmini (in press)) that the isomorphism effect reported in previous studies seems to reflect differ-

ences between children and adults in the operation of the parser rather than differences between children's emerging grammatical systems and those of mature speakers.[4] Second, and more importantly, these results underscore the fact that although children's and adults' sentence processing abilities may differ quantitatively, they do not differ qualitatively—at least within the confines of the phenomena under investigation—thereby lending support to the Continuity Assumption (Crain and Thornton (1998), Pinker (1984)).

Naturally, our results also leave open a number of potentially interesting questions. An important issue concerns the precise nature of the difference between children and adults. As discussed earlier, the isomorphic effect observed in children in the case of sentences such as *Cookie Monster didn't eat two slices of pizza* represents an exaggerated preference also observable in adults. As a reviewer pointed out to us, there are at least two ways in which this difference could be explained. On the assumption that there is a preference for one of the two readings of sentences such as *Cookie Monster didn't eat two slices of pizza*—and, consequently, that the less preferred reading is more difficult to access—judging the truth of such statements presumably involves the following two components: (i) the relative difficulty of obtaining each interpretation and (ii) the ability to override this difficulty to obtain a reading that is true.

Component (i) can be viewed as the "processing difficulty" associated with each interpretation, and (ii) can be construed as a "principle of charity," that is, giving the puppet credit for speaking truthfully whenever this is possible. Given this state of affairs, there are now two ways in which the difference between children and adults can be accounted for. One possibility is that the difference hinges on (i). In other words, what is difficult for adults to process is even more difficult for children to process—hence the exaggerated preference. Another possibility is that children and adults differ with respect to the principle of charity, that is, (ii). On this scenario, (i) is the same for children and adults, but for some reason, children do not apply the principle of charity in an adult-like manner.

Although the data presented here do not allow us to tease apart the two possibilities outlined above, it is worth observing that the results from Experiment 2 pose an additional challenge. What needs to be explained here is why only children display the isomorphism effect in the case of sentences such as *Cookie Monster didn't eat two slices of pizza* (i.e., the object case), whereas both children and adults display the effect in the case of sentences such as *Two frogs didn't jump over the rock* (i.e., the subject case). Another way to put the question is to ask why adults apply the principle of charity in the object case but not in the subject case (after all, in both cases, the nonisomorphic interpretation is an option made avail-

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[4]Admittedly, showing that children and adults behave alike in their interpretation of sentences containing a numerally quantified subject and negation does not necessarily entail that children's isomorphic interpretation of numerally quantified objects with respect to negation must also be due to parsing factors.

able by the grammar, and it is also true in the relevant contexts). One approach, inspired by recent models of sentence processing (Trueswell et al. (1999)), would be to view relative processing difficulty and satisfaction of the principle of charity as probabilistic constraints exerting antagonistic forces: The greater the processing difficulty associated with a particular reading, the more likely it is that this difficulty will override the application of the principle of charity. Notice that this, in turn, implies that the nonisomorphic reading is harder to access in the subject case than in the object case (assuming, of course, that the cost associated with the satisfaction of the principle of charity remains constant).

These considerations bring to mind another potentially interesting difference between sentences such as *Cookie Monster didn't eat two slices of pizza* and *Two frogs didn't jump over the rock.* Notice that although both sentences can be interpreted on what we have been calling a nonisomorphic interpretation, the grammatical mechanisms involved in the derivation of the nonisomorphic interpretation are generally regarded to be different in each case. That is, whereas interpreting the subject NP within the scope of negation in the case of *Two frogs didn't jump over the rock* presumably involves reconstruction (i.e., interpreting the subject in its verb phrase internal position and hence in the c-command domain of negation), interpreting the object as taking wide scope with respect to negation in *Cookie Monster didn't eat two slices of pizza* involves some form of quantifier raising (see Reinhart (1997) for a specific proposal). Other factors, such as the tendency to interpret subjects as topics—and hence as taking scope over other sentential operators—are also likely to contribute to the difference under consideration.

To complicate matters further, recall that although adults display the isomorphic effect in the case of sentences such as *Two frogs didn't jump over the rock,* they highly favor the nonisomorphic reading of sentences such as *Every horse didn't jump over the fence* (Musolino et al. (2000), Musolino and Lidz (2003)). Thus, although syntactic position plays an important role in the contrast discussed previously, that is, *Two frogs didn't jump over the rock* versus *Cookie Monster didn't eat two slices of pizza,* an account based on syntactic position alone is not enough to account for the asymmetry between sentences such as *Two frogs didn't jump over the rock* and *Every horse didn't jump over the fence.* What seems clear here is that the nature of the quantifier phrase (QP) involved (i.e., indefinite vs. universal) also plays an important role in accounting for the preferences under consideration.

A promising observation in this regard comes from the existence of a crucial difference in the entailment relations holding between the alternative interpretations of sentences such as *Two frogs didn't jump over the rock* and *Every horse didn't jump over the fence.* Notice that in the case of sentences such as *Every horse didn't jump over the fence,* the "none" (i.e., isomorphic) reading entails the "not all" (i.e., nonisomorphic) reading. That is, if it is true that none of the horses jumped over the fence, then it necessarily follows that not all of them did, but not

vice versa. By contrast, no such relation holds between the alternative interpretations of sentences such as *Two frogs didn't jump over the rock.* In other words, either scope reading, that is, *not > two* or *two > not,* can be true or false independently of the other.

As is well known in the pragmatics literature, entailment relations typically give rise to scalar implicatures (Grice (1989), Horn (1972), among many others). Scalar implicatures arise in examples such as (7) in which the speaker's use of *some* generally indicates that he or she had reasons not to use a more informative term, for example, *all.* Thus, the use of *some* in (7) gives rise to the implicature in (8).

(7) Some papers got accepted.

(8) Not all papers got accepted.

What defines informational strength here is precisely the presence of entailment relations. So, for example, *all the papers got accepted* entails that some of the papers got accepted but not vice versa.

Notice now that by virtue of the entailment relation holding between the none and the not all reading, the same reasoning can be applied to sentences such as *Every horse didn't jump over the fence.* On this view, the preference seen in adults for the not all reading stems from the inference that the more informative none reading does not hold. Intuitively, this inference follows from the fact that if the none reading was what the speaker had intended to convey, she or he would have opted for the more informative *None of the horses jumped over the fence* (see Horn (1989) for an account along these lines). Thus, on this view, the asymmetry mentioned previously regarding the way adults interpret sentences such as *Two frogs didn't jump over the fence* and *Every horse didn't jump over the fence* receives a principled explanation: It reduces to an independently motivated pragmatic phenomenon, scalar implicatures, itself anchored in fundamental semantic properties of QPs, that is, the entailment relations to which they give rise.

Finally, it is worth asking why the presence of a preceding affirmative statement, as in *Two frogs jumped over the fence but two frogs didn't jump over the rock,* makes it easier for participants to access the nonisomorphic interpretation (see Experiment 3 and Musolino and Lidz (2003) for similar evidence with children). It is relevant to observe here that negative statements have been argued to be easier to process when certain felicity conditions are met (Horn (1989), Wason (1965)). Horn (1989), citing Wason and others, summarizes this idea as follows (also see de Villiers and Tager Flusberg (1975) for a similar observation):

> Very simply, the function of negative sentences is "generally to emphasize that a fact is contrary to an expectation" (1965:7). Negative statements by their nature "assume and depend on a prior state of affairs, either existent or supposed. . . . It is unlikely that the sentence 'It is not x' would be uttered unless there were good reason to suppose that it might have been 'x' or that someone thought that it might"

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> (Cornish and Wason 1970:113). Thus, *5 is not even* is harder to process and takes longer to verify than *5 is odd,* but the difficulty is mitigated if we set up a "context of denial": 4 is even {and/but} 5 is not even (cf. Greene 1970a:18; Wason 1972:28). Psychologically, if not ontologically, negation seems to require—or at least to strongly prefer—an affirmative context against which to operate. (p. 172)

Thus, it is conceivable that the presence of the preceding affirmative statement in examples such as *Two frogs jumped over the fence but two frogs didn't jump over the rock* provides just the kind of necessary positive expectation against which the subsequent negative statement can be felicitously assessed. Notice that in this case, the relevant positive expectation may also come from the context of the story. That is, in the story corresponding to the statement *Two frogs jumped over the fence but two frogs didn't jump over the rock,* a positive expectation may arise from the simple fact that both frogs initially succeed in jumping over the fence (see Experiment 3). Notice now that in the story corresponding to statements such as *Two frogs didn't jump over the rock,* no prior action successfully performed by both characters takes place that would lead to the desired positive expectation. It therefore remains an open question whether the effect observed in Experiment 3 is due solely to the presence of a preceding affirmative statement or to the contextual expectation arising from an initial action being successfully performed by both characters (or to a combination of these two factors).

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We are engaged in a continuing collaboration in which the order of names alternates from one article to the next. We contributed equally to the work reported here.

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REFERENCES

Crain, S. and R. Thornton (1998) *Investigations in Universal Grammar: A Guide to Research on the Acquisition of Syntax and Semantics,* MIT Press, Cambridge, Massachusetts.

de Villiers, J. and H. Tager Flusberg (1975) "Some Facts One Simply Cannot Deny," *Journal of Child Language* 2, 279–286.

Freeman, N. H., C. G. Sinha, and J. A. Stedmon (1982) "All the Cars—Which Cars? From Word to Meaning to Discourse Analysis," in M. Beveridge, ed., *Children Thinking Through Language,* Elsevier Science, Amsterdam, The Netherlands.

Grice, P. (1989) *Studies in the Way of Words,* Harvard University Press, Cambridge, Massachusetts.

Gualmini, A. (in press) "Children Don't Lack *Some* Knowledge," *Linguistics.*

Horn, L. (1972) "On the Semantic Properties of the Logical Operators in English," Doctoral dissertation, University of California, Los Angeles [distributed by IULC, Indiana University].

Horn, L. R. (1989) *A Natural History of Negation,* University of Chicago Press, Chicago, Illinois.

Lidz, J. and J. Musolino (2002) "Children's Command of Quantification," *Cognition* 84, 113–154.

Musolino, J. (1998) *Universal Grammar and the Acquisition of Semantic Knowledge: An Experimental Investigation of Quantifier-Negation Interactions in English,* Doctoral dissertation, University of Maryland at College Park.

Musolino, J., S. Crain, and R. Thornton (2000) "Navigating Negative Quantificational Space," *Linguistics* 38, 1–32.

Musolino, J. and J. Lidz (2003) "Why Children Aren't Universally Successful With Quantification," ms. submitted for publication.

Pinker, S. (1984) *Language Learnability and Language Development,* Harvard University Press, Cambridge, Massachusetts.

Reinhart, T. (1997) "Quantifier Scope: How Labor Is Divided Between QR and Choice Functions," *Linguistics and Philosophy* 20, 335–397.

Trueswell, J. C., I. Sekerina, N. M. Hilland, and M. L. Logrip (1999) "The Kindergarten-Path Effect: Studying On-Line Sentence Processing in Young Children," *Cognition* 73, 89–134.

Wason, P. (1965) "The Contexts of Plausible Denial," *Journal of Verbal Learning and Verbal Behavior* 4, 7–11.

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