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RESEARCH

The scope of children's scope: Representation, parsing and learning

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This paper reviews some developmental psycholinguistic literature on quantifier scope. I demonstrate how scope has been used as a valuable probe into children's grammatical representations, the nature of children's on-line understanding mechanisms, and the role that experience plays in language acquisition. First, children's interpretations of certain scopally ambiguous sentences reveals that their syntactic representations are hierarchical, with the c-command relation playing a fundamental role in explaining interpretive biases. Second, children's scope errors are explained by incremental parsing and interpretation mechanisms, paired with difficulty revising initial interpretations. Third, a priming manipulation reveals that children's clauses, like those of adults, are represented with predicate-internal subjects. Finally, data on scope variation in Korean reveals that in the absence of disambiguating evidence, parameter setting is an essentially random process. Together, these discoveries reveal how the developmental psycholinguistics of scope has proved a valuable tool for probing issues of grammar, parsing and learning.

Keywords: quantifiers; negation; scope; isomorphism effect; parsing; learning

1 Introduction

Consider the following dialog between a mother and her son, overheard in the fall of 2008.

(1) Mom: If all of us don't go to back to school night, it'll be okay because one of us will be there.
Five-year-old: That doesn't make any sense.

What makes this dialog interesting is that the first sentence is ambiguous but the two participants in the dialog interpret it in opposite ways. The mother intended her sentence to convey the meaning that "not all of us goes", whereas the child interpreted it as conveying that "none of us goes." Because they reached different interpretations of the same sentence, bafflement ensued.

The phenomenon of children interpreting a quantifier and negation as having scope equivalent to the surface form is known as the *observation of isomorphism* (Musolino 1998). Isomorphism has proven to be a valuable probe into the nature of children's grammatical representations, the nature of children's on-line sentence understanding mechanisms, and the nature of grammar learning. The current paper fleshes out this perspective by reviewing previous work which confirmed the following facts: (i) children's syntactic representations are hierarchical, with the c-command relation playing a fundamental role in explaining interpretive biases; (ii) children's scope errors are explained by children's incremental parsing and interpretation mechanisms paired with their trouble revising initial interpretations; (iii) children's clauses, like those of adults, are represented with

predicate-internal subjects; and (iv) in the absence of disambiguating evidence, parameter setting is an essentially random process. Together, these discoveries reveal how the developmental psycholinguistics of scope has proved a valuable tool for probing issues of grammar, parsing and learning.

Section 2 demonstrates that children's scope interpretations are captured by their representation of the relative c-command of scope-bearing elements, highlighting the abstract character of children's syntactic representations. Section 3 probes the pragmatic and parsing contributions to children's scope errors. In this section we see how various extra-syntactic and psycholinguistic factors interact to cause children's errors. In section 4, we return to children's representations, demonstrating through syntactic priming that children's clauses include a predicate-internal subject position. Finally, in section 5 we examine a case where the setting of a parameter with consequences for scope takes place by a random process, due to the lack of information in ambient speech. This section highlights the independence of Universal Grammar from the selection mechanisms through which learners arrive at a particular grammar.

2 The syntactic character of isomorphism

Consider the ambiguous sentences below along with their potential paraphrases.

(2) Every horse didn't jump over the fence
  a. Every horse failed to jump over the fence.
  b. Not every horse jumped over the fence

(3) The Smurf didn't catch two birds
  a. It is not the case that the Smurf caught two birds
  b. There are two birds that the Smurf didn't catch

In each case, two scope readings are possible, indicated by the paraphrases. In (2), when the quantified subject is interpreted outside the scope of negation, the sentence can be paraphrased as (2a), equivalent to "none of the horses jumped over the fence." This reading is called an *isomorphic* interpretation since the scope relation between the quantified subject and negation can be directly read off of their surface syntactic positions. (2) can also be paraphrased as in (2b), in which the quantified subject is interpreted within the scope of negation. This is called a *non-isomorphic* interpretation since in this case surface syntactic c-command domain and semantic scope do not coincide. Similarly, (3) also exhibits an isomorphic interpretation (3a) as well as a nonisomorphic interpretation (3b).

Several studies on the acquisition of quantification have shown that when given a Truth Value Judgment Task (TVJT), preschoolers, unlike adults, display a strong preference for the isomorphic interpretation of sentences like (2–3) (Musolino 1998; Musolino et al. 2000; Lidz and Musolino 2002; Musolino and Gualmini 2004; Noveck et al. 2007, among others). Even in contexts that make the non-isomorphic reading true, children nonetheless display a bias to interpret the relevant sentences under the isomorphic interpretation.

An early question concerning isomorphism was whether it should be described in terms of linear order or hierarchical structure (Lidz and Musolino 2002). Because in English, the subject both precedes and c-commands negation, when the subject is interpreted outside the scope of negation, one might describe this in terms of the precedence relation or in terms of the c-command relation. Similarly, in English, a quantificational object both follows and is c-commanded by negation; so, children's restriction to wide scope negation in that context could be seen equivalently as a preference for scope that matches the linear order or as a preference for scope that matches the hierarchical structure. That is, we might paraphrase "children showed a preference for the isomorphic interpretation" as

"children showed a preference in which the linear precedence relations among the quantifiers mapped to their scope" or as "children showed a preference in which the surface c-command relations among the quantifiers mapped to their scope." Given that ambiguity, it is important to ask which is correct. It is important to note, however, that this a weak question. It does not ask whether c-command or linear order is *responsible* for the isomorphism effect. Rather, it asks merely what the correct description of the effect is. Only after determining the correct description can we ask what the cause of the effect is.

In order to address this question, Lidz and Musolino (2002) examined parallel sentences containing a quantifier and negation in Kannada and English in order to determine whether isomorphism should be described in structural or linear terms. Kannada provided a good testing ground for this question because in that language, unlike English, linear order and hierarchical structure can be easily deconfounded. For example, in (4) the quantifier in object position precedes negation, but negation c-commands the quantifier.

(4) *Kannada*
vidyaarthi eraDu pustaka ooD-al-illa.
student two book read-INF-NEG
'The student didn't read two books.'

Hence, if isomorphism were structurally driven, we would expect wide scope for negation. If it were based on linear order, we would expect wide scope for the object.

Lidz and Musolino found that both Kannada and English speaking children assigned wide scope to negation. This is shown in Figure 1 (adapted from Lidz and Musolino 2002), which plots the proportion of "true" responses in a truth value judgment task as a function of context and language. The condition labeled "not > two" makes the narrow scope interpretation of the quantified NP true and the other interpretation false. In the condition labeled "two > not", the truth values are reversed. Children in both languages accepted the sentence only in the not > two condition.

The fact that children in both languages assigned the same scope suggests that the isomorphism effect should be understood in structural terms, since it is only in that dimension that the two languages are alike.

Building on this observation, Lidz and Musolino (2006) also examined numerally quantified NPs in subject position in Kannada and English, as in (5).

(5) a. eraDu chitte paTNa-kke hoog-al-illa.

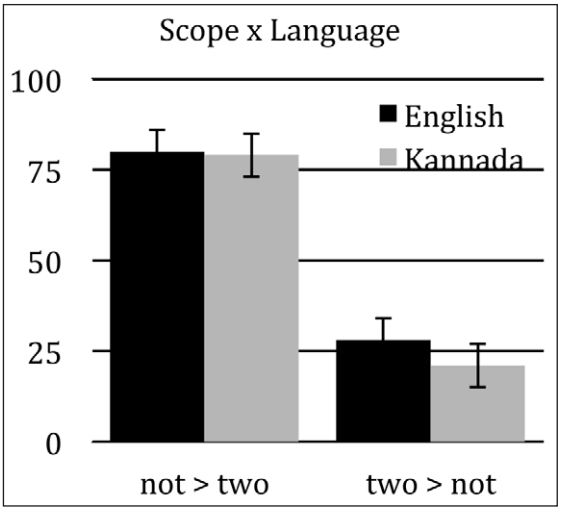

Figure 1: Scope judgments by English and Kannada speaking 4-year-olds.

two butterfly city-DAT go-INF-NEG
'Two butterflies didn't go to the city.'
b. Two butterflies didn't go to the city.

This is important because the isomorphism in (4) may have been due a special property of indefinites requiring them to be interpreted with narrowest scope (Krämer 2000). However, Lidz and Musolino found that children in both languages preferred to interpret the numerally quantified NP in subject position as taking scope over negation. Thus, the preference for assigning narrow scope to the numerally quantified NP in object position is correctly understood in terms of the surface syntactic position of that NP, and not its semantics.

The observation that the isomorphism effect is best understood in structural terms provides a novel kind of evidence for the hierarchical nature of children's syntactic representations. Even when children make errors, these errors are nonetheless best understood as reflecting the same kinds of hierarchical representations that characterize adult languages.

This conclusion, however, still leaves open the question of what factors give rise to isomorphism to begin with. As we will see in the next section, understanding the causes of isomorphism allows us to gain insight into the nature of children's on-line sentence understanding mechanisms.

3 Isomorphism, pragmatics and the parser

In order to account for the observation of isomorphism – as it pertains to universally quantified NPs and negation – Musolino et al. (2000) observed that in Chinese, the equivalent of a sentence like (2) allows only an isomorphic, i.e. 'none' interpretation. They argued, based on the Semantic Subset Principle (Crain et al. 1996), that learners should universally consider a Chinese-type grammar first, so as to avoid the potential problem of having to retract from a more permissive grammar (Berwick 1985; Wexler and Manzini 1987; Pinker 1989; Crain 1994; Crain and Thornton 1998; Goro 2007). For Chinese learners, this would be the correct grammar, but English learners at this stage must ultimately move to a more general grammar on the basis of experience.

However, this analysis of children's isomorphism depends on the effect being due to the grammar and not to other factors having to do with the mechanics of on-line understanding and ambiguity resolution. Indeed, Musolino and Lidz (2006) showed that English-learning 5-year-olds do not have a hard-and-fast ban against nonisomorphic interpretations. When such sentences occur in contrastive contexts like (6), the isomorphism effect is substantially weakened.

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

Viau, Lidz and Musolino (2010), building on Gualmini (2008) and Gualmini et al. (2008), argued that this weakening of isomorphism arose not from the form of (6), but rather to the pragmatic conditions licensing the use of negation. In particular, they argued that negative sentences are typically used to negate expectations that are established in the discourse context. The successful jumping events associated with the first conjunct in (6) are sufficient to create the expectation that every horse would also jump over the fence, the negation of which is the non-isomorphic interpretation of the second conjunct. Indeed, they found that such contexts, even without an explicit contrast, reduced the amount of isomorphism exhibited by preschoolers.

Together, these studies argue that observations of isomorphism do not reflect grammatical knowledge *tout court*. Rather, they arise in children whose grammars generate both

interpretations of such ambiguous sentences and reflect aspects of immature sentence understanding and ambiguity resolution processes.

However, to say that the discourse context surrounding the use of sentences containing quantifiers and negation can impact ambiguity resolution does not yet tell us how discourse contributes to ambiguity resolution and whether it is the only factor that does so. Viau, Lidz and Musolino (2010) addressed the second point by demonstrating that other factors beyond discourse can impact children's interpretations. Specifically, they showed that experience with nonisomorphic interpretations can lead children to access those interpretations even in discourse contexts that otherwise give rise to the isomorphism effect. Using a priming manipulation, they showed that children who heard scopally ambiguous sentences in contexts that were highly supportive of the nonisomorphic interpretation accessed those interpretations more than those who did not. Moreover, they showed that children were able to carry that experience over to less supportive discourse contexts. This priming effect is illustrated in Figure 2.

The prime group in this study first heard 3 items in discourse contexts that set up an expectation that every character would complete the event. They then heard 3 items that did not set up this expectation. The control group heard 6 items that did not set up the relevant expectation. Thus, the first 3 items allow for a replication of Musolino and Lidz's observation that certain discourse contexts increase children's likelihood to access a nonisomorphic interpretation. The second 3 items allow us to ask what the effect of that experience is for subsequent items that lack the supportive discourse context. Because the second 3 items are identical in the two groups, we can see that prior access to the nonisomorphic interpretation leads to an increased ability to access that interpretation even in contexts that lack the helpful discourse features.

Moreover, Viau, Lidz and Musolino (2010) showed that this effect is not simply an effect of pragmatics. Experience with unambiguous sentences like (7), that are synonymous with the nonisomorphic interpretation of (6b), also carried over to the ambiguous cases, leading to higher rates of nonisomorphic interpretations, even when the discourse contexts for (7a–b) were identical.

(7) a. Not every horse jumped over the fence.
b. Every horse didn't jump over the fence.

The fact that nonisomorphic interpretations can be primed allows us to draw the conclusion that aspects of children's on-line sentence understanding and ambiguity resolution mechanisms play a key role in explaining children's bias for isomorphic interpretations.

Lidz and Musolino (2002) and Musolino and Lidz (2003; 2006) pursued this idea by relating it to independent observations that children have difficulty revising their initial

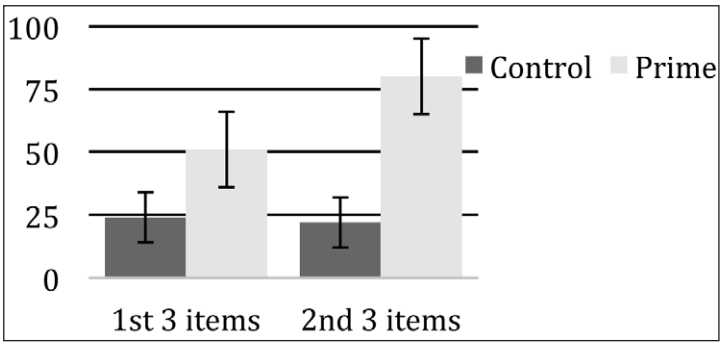

Figure 2: Scope Priming (adapted from Viau, Lidz and Musolino 2010).

parses (Trueswell et al. 1999). In particular, they argued that the isomorphic interpretation is the first interpretation that children access, and that their bias for isomorphism reflects difficulty in revising that initial interpretive commitment. On this view, discourse factors can help the revision process either by providing more salient cues that revision is necessary or by boosting the relevance of the nonisomorphic interpretation to the context, hence making it more likely to be chosen as the first interpretation.

Support for this view comes from several adult studies demonstrating that children's only interpretation corresponds to adults' preferred or initial interpretation (Musolino and Lidz 2003; Conroy et al. 2008). For example, Musolino and Lidz (2003) presented sentences like (8) in contexts that were equally compatible with both interpretations. Such a context, for example had a total of three birds, only one of which was caught. Adults in these contexts explained that the sentence was true because the smurf only caught one bird, illustrating that they had accessed the isomorphic interpretation. They did not say that the sentence was true because of the two uncaught birds, which verify the nonisomorphic interpretation. Thus, although both interpretations can be verified in the context, adults relied primarily on the isomorphic interpretation.

(8) The smurf didn't catch two birds

Similarly, Conroy et al. (2008) asked adults to complete sentence fragments like (9), after hearing a story in which no boys painted the barn and only some of the boys painted the house. Completions with the word "barn" would therefore reflect the isomorphic interpretation and completions with the word "house" would reflect the nonisomorphic interpretation.

(9) Every boy didn't paint the__

When participants were asked to complete the sentence under time pressure, they gave 80% surface scope responses (completing the sentence with *barn*). But, without time pressure they were equally likely to say either *barn* (surface scope) or *house* (inverse scope).

Together, these findings suggest that adults' initial interpretation of such sentences corresponds to the only interpretation that children arrive at, pointing to revision difficulty as a major contributor to their bias (Trueswell et al. 1999; Conroy 2008). Indeed, this hypothesis led to a range of studies in other parts of the syntax-semantics interface showing that children's dominant interpretation corresponds to adults' initial on-line interpretation (Leddon and Lidz 2006; Conroy et al. 2008; Omaki et al. 2014; Omaki and Lidz 2015).

The priming results of Viau, Lidz and Musolino (2010), discussed above, further support the view that isomorphic interpretations come first and need additional support to be overridden. By increasing the baseline likelihood of the nonisomorphic interpretation, revision away from the isomorphic interpretation becomes easier.

In sum, the isomorphism effect first discovered in Musolino 1998 has provided a window not just into the hierarchical nature of our scope representations but also into the nature of on-line sentence understanding and ambiguity resolution processes in children.

4 Children's scope and the predicate internal subject hypothesis

In this section, we return to the question of the linguistic representations engaged by children and what their difficulties with scope can tell us about those representations. The literature on adult syntax provides several arguments that subjects are generated in a VP-internal position and are moved to the surface subject position. We now show how children's isomorphism effects can be used to provide a novel kind of evidence for this syntactic hypothesis.

The argument depends on the interaction between two phenomena that have been argued to implicate VP-internal subjects: scope ambiguity and the interpretation of bare plural subjects.

4.1 Scope and predicate internal subjects

McCloskey (1997) argues that the ambiguity of (10a), in contrast to (10b–c) provides an argument for VP-internal subjects.

(10) a. Every horse didn't jump over the fence
b. A fiat is not necessarily a reliable car
c. A fiat is necessarily not a reliable car

The important thing to notice about these sentences is that (10a) is ambiguous but that neither (10b) nor (10c) is. (10a) can be interpreted as making a strong claim that none of the horses jumped over the fence or a weaker claim that not all of them jumped. This ambiguity concerns the scope of negation. Does the negation apply to something that includes the universal or not? If it does, then we get the weak reading that not all horses jumped. If it does not, then we get the strong reading that none of them did.[1]

How does this scope ambiguity arise? The case where the subject takes scope over negation is straightforward if we assume (uncontroversially) that scope can be read directly off of the hierarchical structure of the sentence. But what about the reading where negation takes wide scope? We can consider two possibilities.

First, it might be that the negation can take the whole sentence in its scope even if it does not occur at the left edge of the sentence. But this possibility is shown to be false by the lack of ambiguity in (10c). If negation could simply take wide scope over the entire sentence independent of its syntactic position, then we would expect (10c) to be ambiguous, contrary to fact. (10c) just cannot mean what (10b) does.

The second possibility is the predicate internal subject hypothesis: the structure of (10a) is really (11), with the struck-out copy of every horse representing the unpronounced residue of the subject-predicate relation:

(11) every horse didn't ~~[every horse]~~ jump over the fence

Given that there are two positions for [every horse] in the representation, we can interpret negation as either taking scope relative to either the higher one or the lower one.

4.2 Bare Plurals and the predicate internal subject hypothesis

Diesing (1992) argues for the predicate internal subject hypothesis on the basis of the interpretation of bare plural subjects, as in (12):

(12) Linguists are available (to argue with)

This sentence is ambiguous between a generic and an existential reading of the bare plural subject. Under the generic reading, it is a general property of linguists (as a whole) that they are available. Under the existential reading, there are some linguists who are available at the moment.

Diesing observes that these two interpretations are associated with different syntactic positions in German. The generic interpretation requires the subject to be outside of the verb phrase. The existential interpretation requires it to be inside the verb phrase

[1] An anonymous reviewer correctly points out that the data in (10) could also be explained by a theory in which negation can move to a position from which it scopes over the entire clause in general, but that this movement is blocked by the adverb. Such a theory would fail to explain the remaining observations of this section, however.

(providing evidence for the availability of the predicate-internal position crosslinguistically). So, Diesing argues that we can capture a cross-linguistic generalization about the interpretations of bare plural subjects by positing that the same mapping between position and interpretation occurs in English. The difference is that in English, the existential interpretation is associated with the unpronounced residue of the subject inside the predicate. This is not exactly evidence in favor of the predicate internal subject hypothesis, but this hypothesis allows us to link the German and English facts together in a way that a theory without this hypothesis would not.

4.3 Priming Scope with Bare Plurals

We are now in position to make an argument that puts three premises together to make a prediction about children's behavior. First, the nonisomorphic interpretation of universally quantified negative sentences involves a predicate internal subject position. Second, the existential interpretation of sentences with a bare plural subject involves a predicate internal subject position. Third, children's bias for isomorphic interpretations is due to extragrammatical factors that can be overcome through priming. Together these premises allow for the following prediction. If children can access the existential interpretation of bare plural subjects, then this interpretation could be used to prime the nonisomorphic interpretation of our universal-negative sentences. Indeed, Sneed (2007) shows that this prediction is borne out.

The first step in Sneed's demonstration was to show that 4-year-olds were indeed able to access both the existential and generic interpretations for bare plurals. She presented children with stories about a zoo in which crocodiles generally could be found in the river area. But one day the zookeeper was cleaning the different habitats and moved some crocodiles to the desert area. She then had children judge the truth of sentences like those in (13).

(13) a. There are crocodiles in the desert/river area
b. Crocodiles are usually in the desert/river area
c. Crocodiles are in the desert/river area.

In the scenario described above, the existential sentence (13a) is true of the desert area but false of the river area. Similarly, the generic sentence (13b) is true of the river area and false of the desert area. And, given the ambiguity of (13c), it is true of the river and true of the desert, but only on different interpretations.

Indeed, Sneed found that children are able to access both interpretations, as illustrated in Figure 3, which shows children's acceptance rates as a function of condition. Children in the "usually" condition accepted the sentence only when it made the generic interpretation true. Children in the "there" condition accepted the sentence only when the existential interpretation was true. And, crucially, children in the "bare plural" condition accepted the sentence in both contexts, suggesting that for children both readings are available.

The second step of Sneed's demonstration was to then use the bare plural sentences as a prime for the interpretation of the universally quantified negative sentences. Children were assigned to one of two conditions. In the existential condition, children were given 3 sentences with bare plural subjects in environments that made the existential reading true and the generic reading false, followed by 3 sentences probing for the nonisomorphic interpretation of sentences like (3). In the generic condition, children were given 3 sentences with bare plural subjects in environments that made the generic reading true and the existential reading false, followed by 3 sentences probing for the nonisomorphic

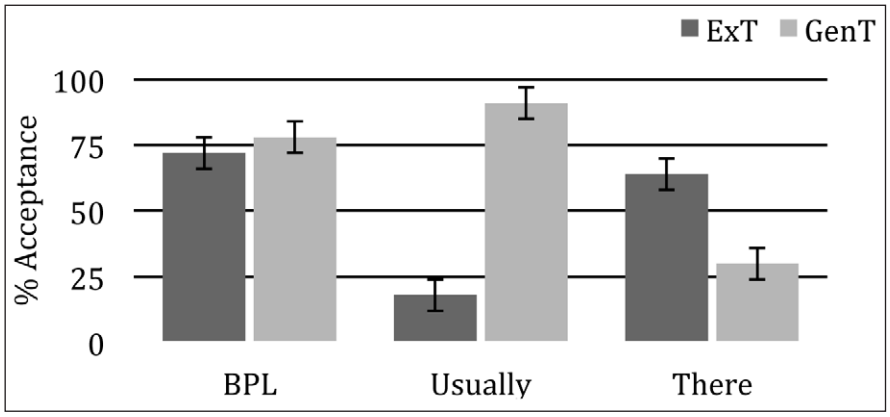

Figure 3: % Acceptance by 4-year-olds for Existential and Generic interpretations in 3 syntactic environments.

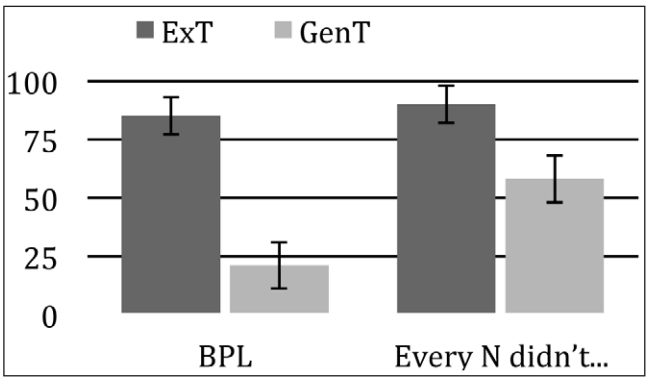

Figure 4: Priming of nonisomorphic interpretation by Existentially interpreted bare plural subjects.

interpretation of universally quantified negative sentences. As illustrated in Figure 4, children in the existential condition showed a higher rate of nonisomorphic interpretations than children in the generic condition.

In short, children who had accessed the existential interpretation of the sentences with bare plural subjects were more likely than children who had only accessed the generic interpretation to also access the nonisomorphic interpretation of the scopally ambiguous sentences. This result suggests a common mechanism underlying these two interpretations, very plausibly the predicate internal subject position.[2]

The study of children's difficulty with scope has thus allowed us to provide a novel kind of evidence about the properties of the syntax of English, and plausibly other languages. In particular, while there was already substantial evidence in favor of the predicate internal subject hypothesis, Sneed's work provides a novel argument from the psycholinguistics of scope in favor of this syntactic hypothesis.

[2] An anonymous reviewer observes that this pattern of facts could be explained by the truth-conditional equivalence of the "not every" reading and an existential one. That is, it could be that the existential reading of the BPL sentences is primed by an existential reformulation of the not > every reading. Such an analysis, while logically possible, implies that this existential reading is not merely entailed, but also psychologically represented as such, a view that strikes me as implausible. See Pietroski et al. (2009) and Lidz et al. (2011) for discussion of the psychological representation of quantification and the lack of psychological potency of all possible logically equivalent reformulations of a sentence's meaning.

5 Children's scope and the character of syntactic learning

The study of scope in children has also allowed for an examination of the character of the learning mechanisms that engage Universal Grammar in development. At stake is the question of how Universal Grammar contributes to language acquisition. Does Universal Grammar fix a unique particular grammar for every language? What processes allow learners to identify particular grammatical features of UG on the basis of their exposure?

The relevant phenomenon comes from the interpretation of quantificational sentences in Korean. Han, Lidz and Musolino (2007) examined the relative scope of a universal quantifier in object position in a clause containing negation, as in (14).

(14) a. Khwuki monste-ka motun khwuki-lul mek-ci ani ha-yess-ta.
Cookie Monster-NOM every cookie-ACC eat-CI NEG do PST-DECL
'Cookie Monster didn't eat every cookie.' (long negation)

b. Khwuki monste-ka motun khwuki-lul an mek-ess-ta.
Cookie Monster-NOM every cookie-ACC NEG eat-PST-DECL
'Cookie Monster didn't eat every cookie.' (short negation)

In principle, such sentences could be compatible with two interpretations. If the universal takes scope over negation, then this would mean that Cookie Monster ate none of the cookies. If negation takes scope over the universal, then it would mean that Cookie Monster ate fewer than all of the cookies. The latter interpretation is compatible with Cookie Monster eating some cookies, whereas the former is not.

Han, Lidz and Musolino relate the interpretations of these sentences to theories of verb placement in the clause, but what is important here is that interpretive judgments in the literature about Korean grammar vary considerably. To probe the source of this variability, Han and colleagues tested adult and 4-year-old speakers of Korean in order to determine which interpretations of such sentences were licensed.

Consistent with the variability in the literature, they found that people differed systematically in their judgments. Roughly half of both populations allowed only the interpretation where the universal takes scope over negation. And roughly half allowed the interpretation where negation takes scope over the universal. This was true for both long and short negation. Moreover, this variability was not simply due to the difficulty of computing interpretations; when the universal was in subject position, all speakers allowed only the interpretation where the universal takes wide scope. Finally Han, Musolino and Lidz (2016) found that speakers were consistent in their judgments across multiple testing sessions, and that they were consistent in their scope assignments for both kinds of negation in Korean. This pattern supports the view that each speaker controls only one grammar, with the variability in scope judgments following from which grammar that is.

Han et al. argue that this variability results from a sparseness of relevant evidence. Sentences like (14) are extremely rare (Gennari and MacDonald 2006), and even if they did occur frequently, their intended interpretation in context is unlikely to be transparent without knowledge of the grammar. Thus, even if UG defines a narrow space of possible grammars, the input to the learner may still be insufficient for deciding which grammar is responsible for the target language. In this case, the absence of evidence leads learners of Korean to pick a grammar, presumably at random. In the vast majority of sentences that learners encounter, this choice has no consequences. But in the case of the relative scope of an object quantifier and negation, the effects of this choice can be seen.

To explore this possibility further, Han, Musolino and Lidz (2016) tested a group of children with their parents. They found again that roughly half of both populations allowed

the universal to scope over negation. However, they found no correlation between parents and their children, consistent with the view that grammar selection in this case is not driven by the environment.

The Korean scope data highlight the independence of UG and a grammar selecting mechanism. UG defines the space of possible grammars, but an additional mechanism allows learners to select a grammar from within that space. In most cases, the selection of an alternative will be driven by the input, and acquisition will be driven by the degree to which learners can identify evidence in favor of one grammar over another (Gibson and Wexler 1994; Frank and Kapur 1996; Yang 2002; Pearl and Weinberg 2007; Pearl 2011; Sakas and Fodor 2012). In the extreme case that there is no relevant evidence, this mechanism chooses a grammar at random from the set of structures licensed by UG.[3] This result illustrates (a) the potential independence of the acquired grammar and the language of the environment and (b) the distinctness of UG and the grammar selection mechanism, since in this case UG specifies the options but fails to determine the acquired grammar.

6 Conclusion

The study of scope in natural language has proven to be a valuable domain for exploring the nature of the syntax-semantics interface. In this paper, we have shown how the study of scope in children has allowed us to gain insight into the kinds of representations that preschool-aged children construct, and into the nature of syntactic representation more generally. By demonstrating that crosslinguistic commonalities in children's isomorphic behavior are best described in hierarchical terms, we learn that children's early syntactic representations are fundamentally continuous with adults', computing interpretation in terms of the relative c-command relations between scope bearing expressions. In addition, we observed that existential interpretations of bare plural subjects, but not generic interpretations, can prime the nonisomorphic interpretation of scopally ambiguous sentences. This priming effect suggests that there is a shared representation between these two structures. We argued that the relevant shared structure is the predicate internal subject position in which the subject is interpreted in these two constructions.

The study of scope in children has also allowed us to gain some insight into the mechanisms that children use to build interpretations in real time. We have seen that children's dominant or preferred scope interpretation corresponds to adults' first interpretation, suggesting that a fundamental source of children's scope limitations derives from the process of revising initial interpretations.

We also saw that children's lack of flexibility can be overcome. Children can access nonisomorphic interpretations when allowing discourse features to play a facilitative role in elevating the likelihood of a dispreferred interpretation. Similarly, prior access to a nonisomorphic interpretation can play a facilitative role, even for sentences that occur in contexts that lack the discourse features that support nonisomorphic interpretations.

Finally, the study of scope in children has allowed to highlight the fact that a theory of universal grammar is not equivalent to a theory of learning, even if it is a major component of such a theory. Universal Grammar allows us to specify the class of possible syntactic representations, but a learning theory must also include a mechanism that maps strings of the language onto those structures. The input to the learner generally plays a selective role, helping learners to choose particular grammatical features from the stock made available by UG. The case of scope variability among speakers of Korean isolates

[3] Note also that a learner in this situation might be expected to maintain both possible grammars in proportion to their fit with the data. Since this is not what we observe, then we can reject all learning theories in which learners maintain multiple alternatives throughout their lifespans.

this mechanism because it is a degenerate case. That is, it provides us with an example of how this mechanism operates even in the absence of data that would allow the learner to decide. The fact that parents and their children differ shows us that the choice of grammar may be driven by properties entirely internal to learners.

Abbreviations

ACC = accusative, DAT = dative, DECL = declarative, INF = infinitive, NEG = negation, NOM = nominative, PST = past

Competing Interests

The author has no competing interests to declare.

References

Berwick, Robert. 1985. *The acquisition of syntactic knowledge*. Cambridge, MA: MIT Press.

Conroy, Anastasia. 2008. *The role of verification strategies in semantic ambiguity resolution in children and adults*. College Park, MD: University of Maryland dissertation.

Conroy, Anastasia, Scott Fults, Julien Musolino & Jeffrey Lidz. 2008. Surface scope as a default: The effect of time in resolving quantifier scope ambiguity. *Poster presented at the 21st CUNY Conference on Sentence Processing*. University of North Carolina, Chapel Hill, March 13.

Crain, Stephen & Rosalind Thornton. 1998. *Investigations in universal grammar*. Cambridge, MA: MIT Press.

Crain, Stephen, Rosalind Thornton, Carole Boster, Laura Conway, Diane Lillo-Martin & Elaine Woodams. 1996. Quantification without qualification. *Language Acquisition* 5. 83–153. DOI: https://doi.org/10.1207/s15327817la0502_2

Diesing, Molly. 1992. *Indefinites*. Cambridge, MA: MIT Press.

Frank, Robert & Shyam Kapur. 1996. On the use of triggers in parameter setting. *Linguistic Inquiry* 27. 623–660.

Gennari, Sylvia P. & Maryellen C. MacDonald. 2006. Acquisition of negation and quantification: Insights from adult production and comprehension. *Language Acquisition* 13. 125–168. DOI: https://doi.org/10.1207/s15327817la1302_5

Gibson, Edward & Kenneth Wexler. 1994. Triggers. *Linguistic Inquiry* 25. 407–454.

Goro, Takuya. 2007. *Language specific constraints on scope interpretation in first language acquisition*. College Park, MD: University of Maryland dissertation.

Gualmini, Andrea. 2008. The rise and fall of Isomorphism. *Lingua* 118. 1158–1176. DOI: https://doi.org/10.1016/j.lingua.2008.02.003

Gualmini, Andrea, Sarah Hulsey, Valentine Hacquard & Danny Fox. 2008. The question-answer requirement for scope assignment. *Natural Language Semantics* 16. 205–237. DOI: https://doi.org/10.1007/s11050-008-9029-z

Han, Chung-hye, Jeffrey Lidz & Julien Musolino. 2007. Verb-movement and grammar competition in Korean: Evidence from quantification and negation. *Linguistic Inquiry* 38. 1–47.

Han, Chung-hye, Julien Musolino & Jeffrey Lidz. 2016. Endogenous sources of variation in language acquisition. *Proceedings of the National Academy of Sciences* 113. 942–947.

Krämer, Irene. 2000. *Interpreting indefinites*. Utrecht: Utrecht University dissertation.

Leddon, Erin & Jeffrey Lidz. 2006. Reconstruction effects in child language. In: David Bamman, Tatiana Magnitskaia & Colleen Zaller (eds.), *BUCLD 30*, 328–339. Somerville, MA: Cascadilla Press.

Lidz, Jeffrey & Julien Musolino. 2002. Children's command of quantification. *Cognition* 84. 113–154. DOI: https://doi.org/10.1016/S0010-0277(02)00013-6

Lidz, Jeffrey & Julien Musolino. 2006. On the quantificational status of indefinites: The view from child language. *Language Acquisition* 13. 73–102. DOI: https://doi.org/10.1207/s15327817la1302_3

Lidz, Jeffrey, Paul Pietroski, Tim Hunter & Justin Halberda. 2011. Interface transparency and the psychosemantics of *most*. *Natural Language Semantics* 19. 227–256. DOI: https://doi.org/10.1007/s11050-010-9062-6

Musolino, Julien. 1998. *Universal grammar and the acquisition of semantic knowledge*: *An experimental investigation of quantifier-negation interactions in english*. College Park, MD: University of Maryland dissertation.

Musolino, Julien & Andrea Gualmini. 2004. The role of partitivity in child language. *Language Acquistion* 12. 97–107. DOI: https://doi.org/10.1207/s15327817la1201_5

Musolino, Julien & Jeffrey Lidz. 2003. The scope of isomorphisim: Turning adults into children. *Language Acquistion* 11. 277–291. DOI: https://doi.org/10.1207/s15327817la1104_3

Musolino, Julien & Jeffrey Lidz. 2006. Why children aren't universally successful with quantification. *Linguistics* 44. 817–852. DOI: https://doi.org/10.1515/LING.2006.026

Musolino, Julien, Stephen Crain & Rosalind Thornton. 2000. Navigating negative quantificational space. *Linguistics* 38. 1–32. DOI: https://doi.org/10.1515/ling.38.1.1

Noveck, Ira, Raphaele Guelminger, Nicolas Georgieff & Nelly Labruyere. 2007. What autism can tell us about every … not sentences. *Journal of Semantics* 24. 73–90. DOI: https://doi.org/10.1093/jos/ffl009

Omaki, Akira, Imogen Davidson White, Takuya Goro, Jeffrey Lidz & Colin Phillips. 2014. No fear of commitment: Children's incremental interpretations in English and Japanese wh questions. *Language Learning and Development* 10. 206–233. DOI: https://doi.org/10.1080/15475441.2013.844048

Omaki, Akira & Jeffrey Lidz. 2015. Linking parser development to acquisition of syntactic knowledge. *Language Acquisition* 22. 158–192. DOI: https://doi.org/10.1080/10489223.2014.943903

Pearl, Lisa. 2011. When unbiased probabilistic learning is not enough: Acquiring a parametric system of metrical phonology. *Language Acquisition* 18. 87–120. DOI: https://doi.org/10.1080/10489223.2011.554261

Pearl, Lisa & Amy Weinberg. 2007. Input filtering in syntactic acquisition: Answers from language change modeling. *Language Learning and Development* 3. 43–72. DOI: https://doi.org/10.1080/15475440709337000

Pietroski, Paul, Jeffrey Lidz, Tim Hunter & Justin Halberda. 2009. The meaning of most: semantics, numerosity & psychology. *Mind & Language* 24. 554–585. DOI: https://doi.org/10.1111/j.1468-0017.2009.01374.x

Pinker, Steven. 1989. *Learnability and cognition*. Cambridge, MA: MIT Press.

Sakas, William G. & Janet D. Fodor. 2012. Disambiguating syntactic triggers. *Language Acquisition* 19. 83–143. DOI: https://doi.org/10.1080/10489223.2012.660553

Sneed, Elisa. 2007. *The acquisition of generics*. Evanston, IL: Northwestern University dissertation.

Trueswell, John C., Irina Sekerina, Nicole M. Hill & Mariane L. Logrip. 1999. The kindergarten-path effect: Studying on-line sentence processing in young children. *Cognition* 73. 89–134. DOI: https://doi.org/10.1016/S0010-0277(99)00032-3

Viau, Joshua, Jeffrey Lidz & Julien Musolino. 2010. Priming of abstract logical representations in 4-year-olds. *Language Acquisition* 17. 26–50. DOI: https://doi.org/10.1080/10489221003620946

Wexler, Kenneth & M. Rita Manzini. 1987. Parameters and learnability in binding theory. *Parameter setting*, 41–76.

Yang, Charles D. 2002. *Knowledge and learning in natural language*. Oxford: Oxford University Press.

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