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## BRIEF ARTICLE

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# The Fleeting Isomorphism Effect

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We demonstrate a U-shaped developmental trajectory in the interpretation of scopally ambiguous sentences, with 4-year-olds and adults, but not 5-year-olds, accessing inverse scope. These results argue against any view that treats 5-year-olds' failures as resulting from immaturity of a single mechanism. Instead, we propose that this developmental pattern derives from the development of (a) parsing mechanisms that generate multiple interpretations in addition to (b) processes involved in selecting or revising among these.

### 1. INTRODUCTION

Scopally ambiguous sentences are frequently used as a tool to investigate ambiguity resolution in children. In this domain, children's ability to demonstrate their knowledge varies widely. One finding is that in some experiments, specifically with sentences containing a quantificational NP and negation, children exhibit nonadult behavior. That is, children access only the surface scope interpretation of the scopally ambiguous sentence in scenarios where adults easily access inverse scope interpretations (Musolino, Crain, & Thornton 2000). This observation is called the "isomorphism effect."<sup>1</sup> However, this finding is subject to a great deal of controversy, as it is not robust across experimental conditions. Many experiments report that children can obtain inverse scope interpretations under certain experimental manipulations (Musolino & Lidz

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<sup>1</sup>We will refer to the behavior of children accessing surface scope interpretations in experiments where adults do not as the "isomorphism effect," without making assumptions as to the source of this effect.

2006; Gualmini 2004). At the center of the debate surrounding children's ambiguity resolution abilities is the nature of children's shortcomings in the cases where they fail to access adultlike readings. One view is that the children's shortcomings derive from having nonadultlike parsers or parsing resources. A second view is that children's only shortcomings are an inability to overcome experimental infelicity, and that these shortcomings do not represent linguistic processing systems that differ from those of adults.

In this article, we suggest that neither a parsing nor a pragmatic account can fully explain the developmental trajectory of children's resolution of scopal ambiguity. We suggest that age is a factor in explaining variability in children's interpretations of scopally ambiguous sentences. We find that the studies that observe nonadultlike behavior test 5-year-olds, while the studies that find adultlike behavior test 4-year-olds. Although previous studies have hinted at the existence of an age effect (Gualmini, Hacquard, Hulsey, & Fox 2005), this has not been systematically tested. We test 4- and 5-year-old children on sentences containing a subject universal quantifier and negation, a construction that has presented mixed results concerning the isomorphism effect (Musolino et al. 2000; Gualmini et al. 2005). We confirm that 4-year-olds appear adult-like, and that 5-year-olds do not, presenting a U-shaped pattern of development for the resolution of scope ambiguity.<sup>2</sup> Previous research has assumed that the (surface scope) nonadultlike behavior of children is the starting point of development. Our findings, that younger children appear adultlike, suggest that this assumption need not be the case, and forces a more careful look at the developmental trajectory of this phenomenon. We argue that this developmental trajectory must be accounted for by a combination of the developing parser and pragmatic abilities, suggesting that previous accounts which appeal to a single explanatory mechanism are insufficient.

## 2. CHILDREN'S INTERPRETATIONS OF SCOPALLY AMBIGUOUS SENTENCES

First, we will review the findings concerning how children interpret scopally ambiguous sentences, examining studies where the presence and absence of an isomorphism effect is attested. In the next section, we will review the current explanations for children's behavior.

Sentences that contain a quantified NP and negation yield interpretive ambiguity. For example, (1) can mean either *none of the horses jumped* (the isomorphic, or surface scope, interpretation) or *not every horse jumped* (the non-isomorphic, or inverse scope, interpretation).

- (1) Every horse didn't jump over the fence

However, not all sentences with a quantified NP and negation are ambiguous.

- (2) The detective didn't find someone

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<sup>2</sup>Throughout this article, we will discuss 4- and 5-year-olds. However, it is most likely the case that age is only a loose predictor of the actual factors that underlie linguistic development.

One might imagine two interpretations for (2): *it's not the case that someone was found* or *someone remained unfound*. However, adult English speakers appear restricted to the inverse scope interpretation.<sup>3</sup>

Musolino et al. (2000) found that 5-year-olds exclusively access the surface scope interpretation of sentences like (1) and (2). Musolino et al. conducted a study using a truth value judgment task (TVJT), in which a story is acted out with characters, and a puppet attempts to describe what happened in the story (Crain & McKee 1985; Crain & Thornton 1998). The child's task is to judge whether the puppet was right or wrong about what happened in the story. The task is designed so that the truth value of the two interpretations of the target sentence differ, so that the experimenter can infer the child's interpretation from the child's judgment of the truth of the target sentence. To test children's interpretations of sentences like (1), Musolino et al. presented children with a story in which there are three horses, and ultimately, two jump over a fence and one fails. In this scenario, the inverse scope interpretation is true because one horse failed to make it over the fence. The surface scope reading is false, because two horses succeeded in jumping the fence. Musolino et al. found that 0% of 5-year-olds and 15% of 6-year-olds interpreted the target sentence under the inverse scope interpretation. This acceptance rate contrasts with the adults, who accepted the inverse scope interpretation 100% of the time. Musolino & Lidz (2006) replicated this effect with children aged 5;0–5;11, who accepted the inverse scope interpretation only 15% of the time.

The finding that children adhere to surface scope interpretations also holds with sentences like (2). Musolino et al. (2000) tested sentences like (2) in a scenario where a detective found some boys who were hiding, but failed to find others. The inverse scope interpretation of (2) is true, because there exist some boys the detective failed to find. The surface scope interpretation is false, because it is not true that the detective found no one. Musolino et al. tested two groups of children. The younger group, aged 3;10–5;2 (mean 4;7), accepted the inverse scope interpretation 35% of the time. The older group, aged 5;2–6;6 (mean 5;7), accepted the inverse scope interpretation 65% of the time. Adult controls accepted the target sentence 100% of the time. Musolino et al. conclude that there exists an isomorphism effect, as younger children more frequently reject the inverse scope interpretation than older children and adults.

Although it appears that children more frequently access the surface scope interpretation than adults, it is not the case that children are completely restricted to surface scope interpretations. Gualmini (2004) and Gualmini et al. (2005) have shown that for sentences like (1) and (2), children can obtain inverse scope interpretations. We will review the experimental modifications that allow children to demonstrate this knowledge. With respect to children's performance on sentences like (1), Gualmini et al. (2005) suggested that in the stories in Musolino et al. (2000), it was not the case that *all of the horses jumping over the fence* was the main focus of the story, which is required to make felicitous a statement like *not all of the horses jumped over the fence* (the inverse scope interpretation). Therefore, Gualmini et al. presented children with sentences like (3), following a story where the character Caillou attempted to deliver all of the letters, but succeeded in only delivering some of them.

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<sup>3</sup>It appears to be the case that in certain contexts, adults accept the surface scope interpretation of these sentences. We have no explanation for this fact, and it is the main reason we focus instead on sentences like (1), where adults accept either interpretation.

## (3) Every letter wasn't delivered

Because the main focus of the story in Gualmini et al. (2005) was whether or not all of the letters were delivered, the inverse scope interpretation of (3) was felicitous. In this experiment, children accepted the inverse scope interpretation 81% of the time (3;0–5;7,  $m = 4;8$ ). This finding suggests that the methodological changes affect children's interpretations, and that children's adherence to surface scope interpretations in previous experiments was a result of the infelicity in the experimental items. Interestingly, the younger children obtained more inverse scope interpretations than the older children. If we divide the children in Gualmini et al. (2005) around the age of 5;2, we can detect an effect of age, as the 10 children in the younger group accepted the target sentence 75% of the time, while the five children in the older group never accepted the target sentence. However, because age was not the focus of investigation in Gualmini et al.'s studies (2005), it is difficult to draw conclusions from a group of 10 and five children. Therefore, we cannot be sure if the methodological variations can completely account for the effect, or if age plays a role in explaining children's interpretations.

Gualmini (2004) also demonstrated that children can access inverse scope interpretations with sentences like (2). For sentences containing negation and an existentially quantified object, Gualmini (2004) noticed that the trials in the Musolino et al. (2000) experiment differed in the degree to which the target sentence was appropriate for the discourse context in the experiment. Gualmini (2004) suggested that children's adherence to surface scope interpretations derived from these infelicitous targets. To test this hypothesis, Gualmini (2004) performed a TVJT with the target sentences in (4) and (5), two sentences which differ in felicity with respect to the same story, to systematically test the effects of felicity on interpretation. These sentences followed a scenario in which multiple guys hide, and the firefighter finds some, but misses others.

- (4) The firefighter didn't find some guys
- (5) The firefighter didn't miss some guys

The inverse scope interpretations (*there are some guys the firefighter didn't find* for (4) and *there are some guys the firefighter didn't miss* for (5)) are both true. Likewise, the surface scope interpretations are both false. However, the two target sentences differ in their felicity conditions. In order for the use of negation to be felicitous, it must be the case that, in the story, the character was attempting to perform an action, but then failed to. In the case of (4), the felicity conditions are clear, as it is the case in the story that the firefighter attempted to find all of the guys, but could not succeed due to the difficulty of the task. However, this felicity condition is not met in (5). That is, it is not the case that the firefighter's goal was to miss the guys, and that he failed. Therefore, the target sentence in (5) is less felicitous than (4) with respect to the scenario.

Gualmini (2004) tested two groups of children. The group of children ( $n = 15$ , 4;0–5;7,  $m = 4;11$ ) that received sentences like (5) accepted these sentences only 50% of the time, demonstrating an isomorphism effect. However, the group of children ( $n = 15$ , 4;0–5;5,  $m = 4;10$ ) that received sentences like (4), the more felicitous target sentence, accepted it 90% of the time, indicating that the children accessed inverse scope interpretations. Here too, it appears that the experimental manipulations affected children's interpretations.

We will review the explanations for the source of the isomorphism effect in the next section.

### 3. THE SOURCE OF THE EFFECT

The debate about children's shortcomings in accessing inverse scope interpretations has centered around whether children have different parsing resources from adults. In this article, we will refer to the generation of alternatives and the mechanisms of selection as the "parser," and refer to all other information external to the parser as "discourse information." We will consider the grammar outside this division of labor. Pragmatic difficulties, such as children's inability to overcome experimental infelicities, will be treated as a specific instance of nonadultlike discourse integration abilities.

Musolino & Lidz claim that children's adherence to surface scope interpretations is due to limited parsing resources, such that obtaining the inverse scope interpretation is difficult except under exceptional experimental manipulations (Lidz & Musolino 2002). For example, it may be the case that children initially obtain the surface scope interpretation because they lack the resources to perform the revision required to obtain inverse scope interpretations on a regular basis (Trueswell, Sekerina, Hill, & Logrip 1999; Novick, Trueswell, & Thompson-Schill 2005).

Gualmini has shown that children obtain inverse scope interpretations underrevised experimental conditions, and concludes that children's only shortcoming is that they are nonadult-like in their ability to utilize contextual information in the selection of an alternative (Gualmini 2004; Hulsey, Hacquard, Fox, & Gualmini 2004). For example, it may be that children are unable to accommodate pragmatic infelicities, and therefore, adhere to surface scope interpretations in certain experimental conditions. Hulsey et al. (2004) proposed that children can only obtain interpretations that align with the "question under discussion" in the experimental scenario. Therefore, in cases where the surface scope interpretation of the target sentence more felicitously addresses the question under discussion, children will prefer the surface scope interpretation.

While it is surely the case that pragmatic considerations impact children's abilities to access inverse scope interpretations, such features are not the only factor that differs between studies which demonstrate an isomorphism effect and those that do not. The mean age of the children participating in the experiment also differs. Across both experiments that we have reviewed, Gualmini tested children nearly a full year younger than Musolino & Lidz, leaving open the possibility that the variability in rates of acceptance of inverse scope is a result of age-related factors. Therefore, we cannot conclusively determine whether the differences in rates of inverse scope interpretations are due to methodology or age. The question remains as to whether the integration of discourse information can entirely account for the isomorphism effect. In this article, we investigate the developmental trajectory of children's scope ambiguity resolution. We suggest that the apparent disparity between previous results can be accounted for by developmental changes in ambiguity resolution strategies. We suggest that this developmental curve must be accounted for by changes in both parsing and discourse abilities.

### 4. CURRENT STUDY

We conducted an experiment across a range of ages, holding methodology constant, to determine whether the age differences observed in and across previous experiments could account for the variance in children's interpretations. In this experiment, we test a construction that contains

the universal quantifier and negation, which has been reported to show an isomorphism effect (Musolino et al. 2000; Musolino & Lidz 2006).

#### 4.1. Hypotheses and Predictions

One hypothesis is that children, due to limitations of their parsers, are unable to access the inverse scope interpretation except in cases with significant contextual assistance (Lidz & Musolino 2002). One implementation of this idea is that children initially access surface scope interpretations and have great difficulty performing the revision required to access the inverse scope interpretation. This hypothesis predicts difficulty in accessing inverse scope interpretations at the earliest possible age, persisting until the child is old enough to have developed the adult-like parsing resources that make revisions easier.

A second hypothesis is that children's parsers are completely adult-like, and that the isomorphism effect derives completely from children's inability to accommodate infelicitous experimental conditions (Gualmini 2004), a specific instance of failure to integrate discourse information in an adult-like way. According to this hypothesis, given appropriate experimental conditions, both 4- and 5-year-olds will access inverse scope interpretations.

A third hypothesis is that the previous results can be accounted for by an age effect. That is, 4-year-olds readily access inverse scope interpretations, but 5-year-olds do not. This predicts that if we test 4- and 5-year-olds on scopally ambiguous sentences, the 4-year-olds should obtain higher rates of inverse scope interpretations than the 5-year-olds. Of course, one ultimately wants an explanation of why age is a predictor of the degree of isomorphism found in children. In what follows, we propose that the developmental change responsible for this shift in behavior resides in the parser, but we reject the hypothesis that isomorphism results solely from a deficit in revision abilities that is characteristic of early parsing abilities.

#### 4.2. Design

We conducted a TVJT, with target sentences similar to the sentence in (6a). The target sentence followed a story in which three cats attempt to hide behind the sofa, but only two succeed, modeled after Musolino et al. (2000). A script for this story is given in (6b). The final scene is shown in Figure 1. The story context meets the felicity conditions raised by Gualmini (2004), in that it is both probable that *no cats hid* and that *not all cats hid*. Additionally, it is emphasized that it is the characters' goal to all hide behind the sofa.

- (6) a. Every cat didn't hide behind the sofa.  
 b. In this story, three cats are playing hide-and-seek with a dog. The cats first consider hiding behind the sofa. They initially reject this as a hiding place because the dog might see them running from their initial hiding place behind the box. [At this point in the story, the possibility that no cats hide behind the sofa is made salient as a possible outcome]. The cats soon realize that their hiding place behind the box is not very good because it is easy to see around the box. So, cat 1 and cat 2 run to behind the sofa. At this point, the dog calls out, "Ready or not, here I come." Cat 3 realizes that he can't make it behind the sofa in time and so he ducks down behind the box. [At this point in the story, the possibility that not-all cats will hide behind the sofa is made true].

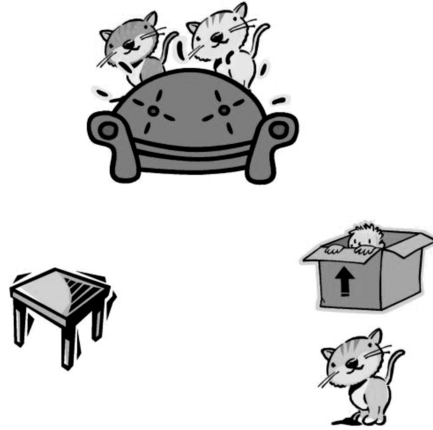


FIGURE 1 Truth value judgment task (TVJT), final scene.

The TVJT was conducted on a computer screen with animated characters. The child was introduced to the computer and told how to play the game. The puppet, a dog, was also on the computer screen, and gave an introduction before beginning the experiment. The movement of each character in the stories was controlled by the experimenter, who told the story verbally. The target sentence was recorded.<sup>4</sup> Children were tested one at a time in a quiet testing room away from other children. The entire session lasted less than 20 minutes.

Each child received two warm-up stories, six targets, and two fillers. The fillers were dynamic, so that the experimenter could choose either a true or false target sentence, depending on the child's previous responses. This ensured that the child answered true and false roughly an equal number of times across the experiment, regardless of his/her interpretation of the target sentences.

#### 4.3. Participants

Children were recruited from a preschool at the University of Maryland. There were two groups of children, 4-year-olds and 5-year-olds, each group consisting of 15 children. One child was replaced in the design for incorrectly answering both fillers. The 4-year-old group ranged from 4;5–5;2 (mean 4;9) and the 5-year-old group from 5;3–5;7 (mean 5;4). The ages of the children in these two groups are statistically different ( $p < .01$ ). These age groups were chosen to maximally match the previous studies conducted. The average age in Gualmini (2004) was below 5;0, while the average age in Musolino and Lidz (2006) was older than 5;0. Furthermore, Gualmini (2004) found an age difference in his study around the age of 5;2. Therefore, we selected 5;2 as a separation point, although we make no claims that critical changes occur

<sup>4</sup>To the best of our knowledge, these stories mimic tasks done with act-out toys, but have the advantage of requiring only one experimenter. We performed a within-subjects experiment with 24 children comparing the computer and live action TVJTs, and found no difference in interpretations (Conroy 2008).

TABLE 1  
Rates of Inverse Scope Interpretation by Age

<i>4-Year-Olds</i>	<i>5-Year-Olds</i>	<i>Adults</i>
81%	44%	76%

at this exact age. Additionally, 12 adults from the University of Maryland served as controls. Adult participants received payment for their participation.

#### 4.4. Results

Adults accepted the puppet's statement, consistent with the inverse scope interpretation, 76% of the time. This acceptance rate is somewhat lower than is standardly reported for a TVJT, and we have no explanation for this fact. Performance with fillers across all groups is over 90%, suggesting overall good performance on the task. Results showing acceptance of inverse scope across all age groups are summarized in Table 1.

We found that the 4-year-olds accepted the inverse scope interpretation 81% of the time. The 4-year-olds accepted the sentences significantly more often than the 5-year-olds did ( $t(14) = 2.06$ ,  $p < .05$ ), but at the same rate as adults. All children were asked for justification for their responses, which were consistent with their true/false answers.

The 5-year-olds accepted the inverse scope interpretation 44% of the time. This rate is significantly different from the 4-year-olds', and marginally different from that of the adults ( $t(25) = -1.93$ ,  $p < .06$ ). The marginal significance results from the lower adult rates of acceptance. The 5-year-old group contains seven children who never accessed the inverse scope interpretation; therefore the low acceptance rate is not distributed evenly across children.

#### 4.5. Discussion

Let's recall the hypotheses and predicted results. If it is the case that children uniformly have nonadult parsing resources and that these are responsible for the isomorphism effect, we expect younger children to behave just like the 5-year-olds, in being restricted to the surface scope interpretation. However, the 4-year-olds accessed inverse scope at the same rates as adults, providing evidence against this hypothesis. Because younger children can obtain the inverse scope interpretation, and presumably younger children do not have more parsing resources than older children, we conclude that the isomorphism effect in 5-year-olds cannot be due solely to immaturity of the sentence parser, as claimed in Lidz & Musolino (2002).

Next, if it is the case that the isomorphism effect is a result of infelicitous materials, then we also expect similar rates of acceptance in both the 4- and 5-year-old age groups. Although previous research has shown that there is certainly an effect of felicity on interpretation, in this experiment, we see interpretation differences across age, and not as a result of methodology, which we held constant. Therefore, we conclude that the isomorphism effect does not solely derive from a failure to experimentally meet certain felicity conditions.



Finally, if it is the case that children's age is a contributing factor in determining their interpretations, then we would expect 4-year-olds to obtain more inverse scope interpretations than 5-year-olds, in order to align with previous results. This prediction is borne out, shedding light on the results obtained in other experiments. Musolino et al. (2000) and Musolino & Lidz (2006) report low rates of acceptance of the inverse scope interpretation, with data from 5-year-olds.<sup>5</sup> Gualmini (2004) found that children readily accessed inverse scope interpretations, with data from 4-year-olds. We found that age is indeed a factor in interpretation, demonstrating a U-shaped curve in children's scope ambiguity resolution abilities. Of course, age is not an explanatory mechanism, so it is important to now investigate what changes in development could give rise to this age-related pattern.

Typically, a U-shaped curve of development is analyzed as the child developing adult-like mechanisms in two stages. As an analogy, we consider the classic example of the acquisition of the English past tense. We will outline the analysis, and then suggest that the child's acquisition of adult-like scope interpretive abilities shows a similar pattern of development. Of course, there are clear differences between learning the past tense and learning the scope possibilities in a language, so we do not suggest that the mechanisms are identical, but we outline this as an example of the style of developmental explanation that we suspect is at work. For the past tense forms of irregular verbs in English, children demonstrate a U-shaped curve of development. That is, they begin by using the correct morphological form (such as *went* for the verb *to go*), then begin using a regularized past tense form (such as *goed*), then finally utilize the appropriate form *went*. At first glance, this pattern seems perplexing, because the child appears to become nonadult-like after a period of producing adultlike forms. However, this pattern is easily explained by appealing to the child's developing abilities to form the past tense in an adultlike way (Brown 1972). The children in the youngest stages, although they produce adultlike forms, are obtaining these forms by nonadultlike means, in this case by simply mimicking their input. At the second stage, children have acquired a general rule for forming the past tense, but are unable to access the irregular past tense form for the verbs that require one. At the final stage, the child has not only acquired the general rule, but also has learned that some verbs form exceptions to this rule. Notice that the child, to obtain adult competence, must acquire two things. First, they must acquire the general rule for forming the past tense, *verb + ed*. Second, they must acquire an exception that overrides the implementation of this general rule for irregular verbs (like *to go*). The crucial part of this analysis is that the apparent nonadultlike behavior of the child represents the child developing the mechanisms that underlie adult behavior. We can restate the U-shaped curve in terms of three stages of development: 1) apparent adult-like behavior by non-adultlike means, 2) nonadult-like behavior by using adult-like processes, and 3) fully adult-like behavior.

We suggest that the same type of account can describe children's development of scope ambiguity resolution. Recall that we have observed that children initially obtain inverse scope interpretations (which appears adult-like), then go through a period of obtaining surface scope

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<sup>5</sup>One reviewer raises Musolino (1998) as a potential conflict to this generalization. Musolino tested children from 4;0–7;2 ( $m = 5;11$ ), and found children adhere to surface scope interpretations. Although this group range begins at 4;0, the sample included only three 4-year-olds. Therefore, the age effect would not be expected to surface statistically.

interpretations. Previous research suggests that when an adult obtains an inverse scope interpretation, two steps are involved. The parser initially accesses a surface scope interpretation, but then revises to an inverse scope interpretation by using some amount of discourse information (Tunstall 1998; Anderson 2003; Conroy 2008; Conroy and Lidz 2008). This is similar to the two steps required in accounting for an adult-like grammar of the English past tense, which requires a general rule, but also the ability to allow exceptions to this rule in the case of irregular verbs. With respect to scope, we propose that the U-shaped curve observed can be described by children first acquiring an adult-like parser, and then adult-like revision capabilities. We claim that children in the initial stages of ambiguity resolution (4-year-olds in this article) are not obtaining inverse scope interpretations by revising through surface scope interpretations, but rather are directly obtaining inverse scope interpretations. Next, the child acquires the adult-like parsing preferences, which default to surface scope interpretations. However, at this stage, the child is not adept at revising his/her interpretation according to contextual information, so remains with the surface scope interpretation. Finally, the child acquires the ability to utilize contextual information as a way of revising their interpretation. This is depicted in Figure 2.

This description of U-shaped development can also be paraphrased into three stages: 1) apparent adult-like behavior by nonadult-like means, 2) nonadult-like behavior by using adult-like processes, and 3) fully adult-like behavior.

The question remains: how could a 4-year-old “directly obtain” the inverse scope interpretation? Here, we put forth a tentative possibility, but realize that further investigation will be required to substantiate it. One possibility is that the difference between 4- and 5-year-olds lies in the speed of their linguistic processing. Let us assume (although this is certainly a gross overgeneralization), that 4-year-olds are slower language processors than 5-year-olds. When a 4-year-old encounters the string *every cat didn't hide*, the child waits until he/she has heard a large portion of the sentence before beginning analysis. In this case, let's assume that the child has both scopal elements *every* and *not* before performing an analysis. This child has an adult-like grammar, which allows both scope possibilities. Musolino & Lidz (2006) found that inverse scope interpretations are more available in the input than surface scope

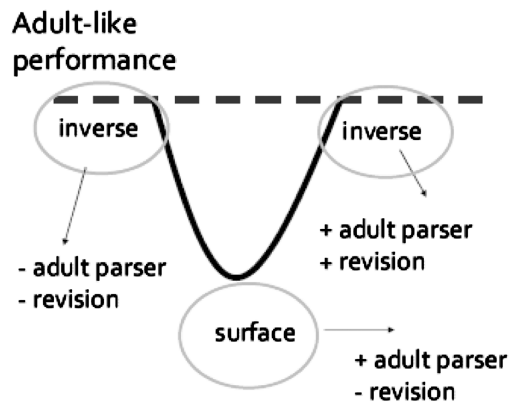


FIGURE 2 Acquisition of scope ambiguity resolution.

interpretations of strings containing a universally quantified subject and negation. Because inverse scope interpretations are more frequent in the input, the child chooses the inverse scope interpretation. Now, let us look at a 5-year-old. We are assuming that these children process language more quickly. Let us assume that what it means to have “an adult-like parser” is to begin building (and predicting) syntactic structure at each word. In this case, the child hears *every* and begins building syntactic structure. This means putting *every* in the subject position, and giving it wide scope at LF. When the 5-year-old encounters *not*, he/she gives *not* narrow scope, because the child has already made a prediction about the interpretation of *every*. While this is not a detailed analysis, we simply want to point out that it is possible that the differences between children with respect to the analyses pursued by their parsers may be the result of factors such as processing speed. If this analysis is on the right track, we will be able to explain why 4-year-olds appear able to access the full range of interpretations provided by their grammars, but 5-year-olds appear restricted to the default interpretations of adults.

## 5. CONCLUSIONS

Previous research on the acquisition of scope ambiguity presents a fractured view of children’s performance. Using a subject universal quantifier and negation, we replicate the long-standing “isomorphism effect” with 5-year-old children. However, we find that age is a leading factor in determining interpretation. We suggest that these results can only be described by appealing to both a developing parser and developing discourse integration abilities. Five-year-olds’ adherence to surface scope interpretations cannot solely be the result of an immature parser, as it is unlikely that the parser loses efficacy as the child gets older. It also cannot be that the isomorphism effect derives strictly from children’s difficulty in accommodation (Gualmini 2004). There is no doubt that children’s interpretations are determined by a complex combination of pragmatic information and parsing costs. Our current data fit with previous work in suggesting that children’s behavior in scope ambiguity resolution can be described by an interaction between the maturing parser and developing discourse integration abilities. Previous work in the domain of scope ambiguity resolution reflects this developmental process.

The stimuli are available online at [www.ling.umd.edu/~jlidz/ushape.html](http://www.ling.umd.edu/~jlidz/ushape.html).

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