

Children's Scope Assignment

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1. Introduction

In English (and in many other languages), a sentence such as (1) is ambiguous: It could have two different interpretations: On one interpretation, it could be paraphrased as *It is not the case that Donald found two guys*. (e.g. Donald found no guys, one guy, three guys, etc.). On another interpretation, it could be paraphrased as *There are two guys that Donald didn't find*. One way, theoretically, to distinguish these two interpretations is to assign them different syntactic parses, assuming, first, that 'two guys' is quantificational, and, second, that 'two guys' and 'not' are scope-bearing elements. On this view, the first meaning is stated to correspond to a "surface scope" interpretation, and the second to an "inverse scope" interpretation, for it is only the first meaning that reflects the surface syntactic position of these two scope-bearing elements (i.e. not > two):

- (1) Donald didn't find two guys.
- It is not the case that Donald found two guys. (not > two → surface)
 - There are two guys that Donald didn't find. (two > not → inverse)

When (1) is uttered in a context where *Donald* finds only two of the four guys available (i.e. He finds two, but fails to find the other two.), the interpretation (1a) would be false, for it is indeed the case that Donald found exactly two guys. Interpretation (1b), on the other hand, would be true, for there are exactly two guys that are not found by Donald.

It has been observed, in child language acquisition research, that, unlike adults, children reject these sentences in truth-value judgment tasks, signaling that they choose the interpretation that makes the sentence false (i.e. (1b)) (e.g. Musolino, 1998; Musolino, Crain, & Thornton, 2000; Lidz & Musolino, 2002). Children do this despite the Maxim of Charity (Grice, 1975), the assumption that a sentence will be accepted when at least one reading makes it true.

Musolino (1998) called this the "Observation of Isomorphism," because these findings seem to suggest that children choose the interpretation where the c-command relations holding between the two quantificational elements (i.e. quantified NP and negation) in the surface syntax map directly to the c-command relations between the same elements in the semantics. This means that a scope-bearing element that c-commands another scope-bearing element in the surface will also have to take scope over it. With respect to (1), then, *not*, which c-commands *two* in the surface syntax, will also be interpreted, by children, as having scope over *two* in the semantic representation (i.e. 'narrow' scope interpretation of the quantified NP). In other words, representation (2a) below will be the one employed by children, though adults can reach (2b), too, where the quantified NP takes 'wide' scope over negation:

- (2)
- $\neg \exists_2 x [\text{guy}(x) \wedge \text{find}(\text{Donald}, x)] \rightarrow \text{surface (= narrow here)}$
 - $\exists_2 x [\text{guy}(x) \wedge \text{find} \neg (\text{Donald}, x)] \rightarrow \text{inverse (= wide here)}$

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Observation of Isomorphism, though, is not without its problems, and findings of previous research are rather conflicting: Children acquiring Dutch, for instance, consistently interpret similar sentences with inverse scope (not surface), although adult speakers can access both interpretations (Krämer, 2000). Furthermore, English children can also reach inverse scope interpretations under appropriate conditions (Gualmini, 2003; 2004; Hulsey et al., 2004).

This paper presents a unified account of these facts based on the Relevance Theory (Sperber & Wilson, 1986/95). We argue that children do not differ from adults in grammar (i.e. The child grammar, like the adult grammar, can assign two parses), and that the apparent Isomorphism effect is an artifact of the experimental conditions in prior studies, caused by children's over-reliance on "salience" as a cue for "relevance." In previous studies, a child rejecting a sentence like (1) was understood to have only the surface scope reading available. The current study shows, however, that children reject (1), because, in the absence of certain expectations created by context (e.g. that *Donald* was supposed to find *all* guys), they make judgments based only on the more salient set of "found guys" out of a set of (a) "found" and (b) "unfound" guys: After all, based only on the set of found guys, it would indeed be false to utter (1) (on both surface and inverse scope readings).

This proposal makes a number of testable predictions: There are, for example, certain cases where children are predicted to be able to access inverse scope interpretations of sentences like (1), i.e. when the set of unfound guys is made more salient or when an expectation that involves *all* four elements in context is presented, which both serve to make the set of unfound guys more relevant. There are also certain other cases where it should be more difficult for children to reach surface scope interpretations, i.e. when the numerally quantified NP is in the subject position as in *Two horses didn't jump over the fence*, where focusing on the more salient set of "jumping horses" out of a set of (a) "jumping" vs. (b) "not jumping" horses would, unlike the object NP cases, lead to an inverse scope interpretation.

To test these predictions, we conducted a series of experiments, and the results of these are in line with the current proposal, but not with the Isomorphism or any other syntactic account.

The paper is organized in the following way: First, in Section 2, previous accounts of children's scope assignment are discussed, together with a review of their problems. Second, the current account is detailed in Section 3; this section also presents the empirical predictions of this account, as well as the results and discussion of a series of experiments done to test these predictions. Finally, Section 4 provides a general discussion and concludes the paper

2. Previous Studies

2.1. The Observation of Isomorphism

Musolino (1998) found that 5-year old children ($n = 20$) accepted sentences like (3) and (4) only 50% of the time whereas adults accepted them around 90% of the time:

- (3) The detective didn't find some guys.
- a. It is not the case that the detective found some guys. (=The detective found no guys.)
 - b. There are some guys that the detective didn't find.
- (4) Every horse didn't jump over the fence.
- a. No horse jumped over the fence.
 - b. Not every horse jumped over the fence.

Musolino argued that these findings indicated that children were interpreting these sentences on their surface scope (Isomorphic) reading whereas adults were adhering to the Principle of Charity, thereby interpreting the same sentences on their inverse scope (non-Isomorphic) reading. Furthermore, when individual children were considered, an interesting pattern appeared: Half of the children judged the sentences true around 90% of the time whereas the other half judged them false, again, around 90% of the time, showing that there were two populations of children: those who are adult-like who choose the true, inverse scope interpretation and those who are child-like who choose the surface scope interpretation even though this is the interpretation that makes the sentence false (i.e. violates the Maxim of Charity). According to Musolino, these results meant that children *cannot* access inverse

scope interpretations!

Later, these results and arguments were supported by further research (e.g. Musolino, Crain and Thornton, 2000; Lidz & Musolino, 2002): Lidz & Musolino (2002), for instance, tested children and adult speakers of English and Kannada on their interpretation of scopally ambiguous sentences involving numerally quantified noun phrases and negation such as (1) *Donald didn't find two guys*, where either negation can take scope over *two guys*, giving rise to a narrow scope interpretation of the quantified NP, or *two guys* can take scope over negation, giving rise to a wide scope interpretation. They found that, when presented with contexts in which either interpretation (but not 'both') was true¹, adults from both languages easily accepted the sentences whereas 4-year old children (n = 12) were reluctant to do so when the wide scope reading was true. In fact, children in this study accepted these sentences only 33% of the time in such conditions. Lidz & Musolino concluded that these results indicate a strong preference, on the part of children, for the narrow scope reading, which corresponds to the surface syntactic structure of the sentence (and thus to the Isomorphic Interpretation).

2.2. *Conflicting Findings and the Weak Isomorphism Account*

Findings of research on children's scope assignment did not always support the Observation of Isomorphism. Gualmini (2003; 2004), for instance, showed that when presented with an appropriate "expectation" such as (5), children could also reach inverse scope interpretations of sentences like (6):

(5) The Troll is supposed to deliver all four pizzas.

(6) The Troll didn't deliver some pizzas.

In particular, Gualmini showed, with 15 subjects (ages 4:1 to 5:6, with mean age 4:10), that children accepted sentences like (6), which involve negation and *some* in object position, 90% of the time when presented with an expectation like (5). When, however, a different group of 15 children (ages 4:2 to 5:8 – mean: 4:11) were presented with (6) without such an expectation, they accepted them only 50% of the time, as in Musolino's experiments.

According to Gualmini, this is because contexts which do not make an expectation such as (5) explicit enough are infelicitous. He suggests that negative sentences are felicitous only when they point out a discrepancy between what is expected to happen and what actually happens (i.e. when they are presented in a context where an expectation goes unfulfilled).

Though this means that the Observation of Isomorphism on its strictest interpretation cannot be correct, for children do indeed reach inverse scope interpretations under certain circumstances, the question of why children cannot reach inverse scope interpretations in the default setting (i.e. in the infelicitous condition on Gualmini's approach), where no expectations are presented, still remains. In other words, the research question that remains to be answered is now not why children *cannot* reach inverse scope interpretations but rather why they *favor* surface scope interpretations more often than inverse scope interpretations.

It is perhaps to answer this new research question that a less stringent (weak) version of the Isomorphism account was first suggested as a possibility in Musolino & Lidz (2003) and was later adopted by Lidz & Musolino (2005-2006) and Musolino & Lidz (2006). According to this new version, Isomorphism emerges as default in infelicitous contexts (i.e. contexts without an expectation that goes unfulfilled), because in such contexts, the processing demand is so high that an initial parse cannot be inverted, the initial parse being the one with the surface scope. This proposal seems to be further supported by the finding that the Isomorphism effect can be induced in adults, too, under

¹ They managed this by having two conditions: In condition 1, Donald finds only two of the four guys available in context, which makes only the inverse scope interpretation true, for there are indeed two guys that Donald didn't find but it is not true that it is not the case that two guys were found. In Condition 2, on the other hand, there are two guys available in context, and Donald finds only one of these and fails to find the other. In such a context, the surface scope interpretation is the only reading that makes the sentence true since it is true that it is not the case that Donald found two guys, because he found only one guy. The inverse scope interpretation, however, makes the sentence false since it is not true that there are two guys Donald didn't find, for there is only one guy Donald didn't find.

certain circumstances that require high processing demands (Musolino & Lidz, 2003).

The weak Isomorphism account would then predict Isomorphism to arise in contexts that do not involve a situation where an expectation goes unfulfilled (Gualmini's infelicitous contexts). Though this is what happens with English-learning children, children learning Dutch behave completely differently: Krämer (2000), for example, showed that Dutch children favor inverse scope interpretations in those contexts rather than surface scope interpretations, even when the latter is what adults prefer. In particular, she presented Dutch children with sentences such as (7) in a context where a boy had caught two of the three fish available, and children rejected these sentences 84% of the time whereas adults always accepted them:

- (7) De jongen heft een vis niet gevangen.
 The boy has a fish not caught
 'There is a fish the boy hasn't caught.'

This means, then, that Dutch children actually prefer inverse scope (non-Isomorphic) interpretations over their surface scope (Isomorphic) counterparts.

This is, though, not the only complication for the Isomorphism account, whether it be the strong or the weak version. Another complication comes from English facts: Children give the same percentage of 'yes' and 'no' answers to active vs. passive versions of sentences like (6) in equally felicitous or infelicitous contexts (Hulsey, Hacquard, Fox, and Gualmini, 2004). This is not what would be expected by an Isomorphism account: An Isomorphism account would predict the percentage of 'yes' and 'no' answers to change depending on whether a sentence is active or passive, for the scopal relations between the quantified NP and negation are reversed in passive sentences. On the other hand, these results could be attributed to other reasons, too. For example, it could be that passives behave differently for other reasons (Musolino & Lidz, 2004) or that double negation in the form of "X didn't lose some Y" in the sentences used by Hulsey et al. put extra processing demand on children, thereby confounding the results (e.g. giving an effect as if children cannot reach surface scope interpretations).

Nevertheless, it seems that even a relaxed version of Isomorphism is unable to explain the relevant phenomenon. It seems also that an adequate account should be able to (a) be not completely based on syntax, and (b) ideally capture the fact that children will reject a sentence like (6) (or one with the verb "lose") possibly for the same reason that they reject its passive version.

Below, I give an account which not only seems to capture these facts and the apparent Isomorphism effect, thereby accounting for the conflicting findings of previous research, but also presents new data from 5-year old children which are unexplainable under existing theories of children's scope assignment. The account I will be arguing for is based on the Relevance Theory (Sperber & Wilson, 1986/1992):

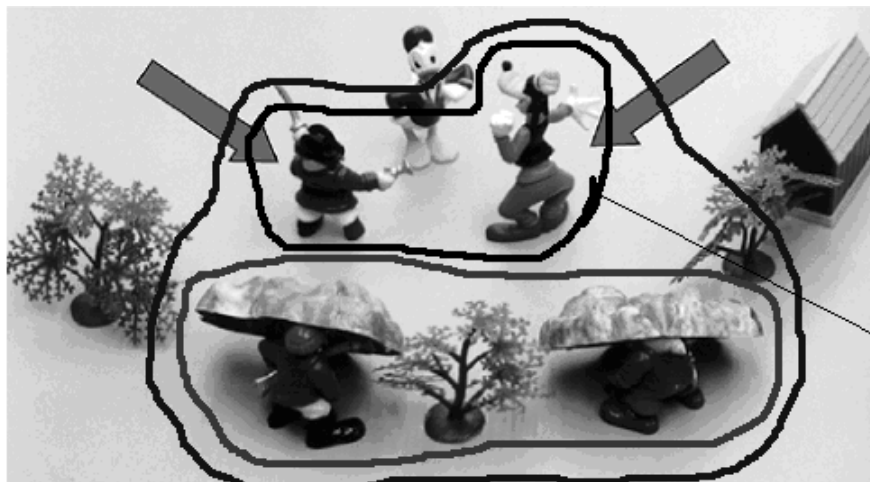
3. The Current Account: Children and Relevance

Below, I first give an overview, in Part 3.1., of the intuitive idea behind the current proposal, and then in Part 3.2., I present a brief introduction to the Relevance Theory. Later, in Part 3.3., I delve more into the proposal made in 3.1., and show how it is based on the Relevance Theory, as outlined in 3.2. This section also presents several empirical predictions that this account makes. Finally, in parts 3.4. and 3.5, I present a number of experiments to test these predictions and their results.

3.1. Main Proposal

I argue that the apparent Isomorphism effect is an artifact of the experimental conditions in prior studies, caused mainly by children's over-reliance on "salience" as a cue for "relevance." In previous studies, a child rejecting a sentence like (1) was understood to have only the surface scope reading available, under the assumption that a sentence will be accepted when at least one reading is true (Maxim of Charity). The current study shows, however, that children reject (1), because, in the absence of certain expectations created by context (e.g. that *Donald* was supposed to find *all* guys), they make judgments based only on the more salient set of "found guys" out of a set of (a) "found" and (b) "unfound" guys:

(8)



(picture originally from Lidz & Musolino, 2002)

After all, based only on the set of found guys (indicated with arrows in (8)), it would indeed be false to utter (1) (on both surface and inverse scope readings). That is, based only on this set, Donald did indeed find two guys! In fact, when children's justifications as to why they reject a sentence like (1) in a context like (8) are taken into account, this idea becomes even more clear: When children reject (1), they often point to the set of found guys, saying, "Donald did indeed find two guys," "Donald found these two guys," etc.

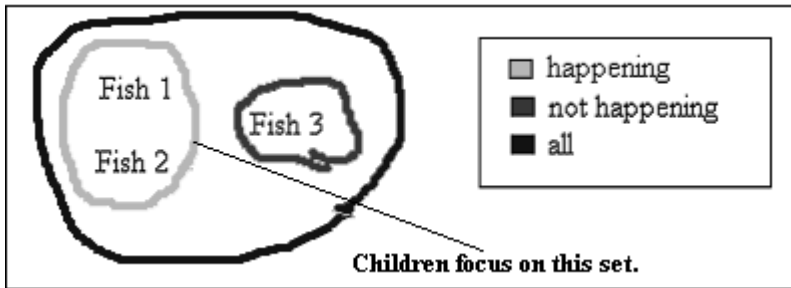
So if Donald found some (or 'two') guys out of a larger set of guys, then some guys will be on the "found" side of him while some others will be on the "not found" side. Again, if the troll (in examples like (6)) delivered some pizzas, some pizzas will be on the "delivered," or "happening" side of the picture, whereas some other pizzas will be on the "not delivered" or "not happening" side. Similarly, if the troll lost some pizzas, as in some of Gualmini's experiments, some pizzas will, this time, be on the "lost" side of the picture while some will be on the "not lost" side.

The argument in this paper is that in each case children will be caring about the what is "happening" side of the picture rather than what is "not happening." And it is exactly for this reason that they seem to be choosing the Isomorphic interpretations, because it is these interpretations which focusing on the "happening" set leads one to. To put it another way, it might be that the reason why children tend to reject sentences with inverse scope reading is because they rank contextual relevance (which, so far, means "salience" for us) higher as a cue for general relevance than the Maxim of Charity. It is, then, a way of thinking like "If the only relevant thing is that Donald found two guys, then, why would I say he didn't find two guys?"

If, however, the set of unfound guys is somehow made more relevant, children would then be able to take this set, too, into consideration and would be able to reach inverse scope interpretations. Now, remember that Gualmini (2003; 2004) presented children with expectations like (5) *The Troll is supposed to deliver all four pizzas* before letting the puppet utter sentences like (6) *The Troll didn't deliver two pizzas*. And children, in that experiment, were able to reach inverse scope interpretations. On the current account, the reason why such an expectation helped children reach inverse scope interpretations is that the word "all" made *all* of the elements involved in the universal set relevant, including the set of "not delivered" pizzas. This is, then, a way of thinking like "If the Troll was supposed to deliver all four pizzas, but in the end he managed to deliver only two, then the fact that he didn't deliver the other two is important/relevant, for it means that the original purpose has not been achieved."

Notice that this proposal also accounts for the Dutch facts of Krämer (2000) which are inexplicable under any syntactic account such as the Observation of Isomorphism. To see this, examine (9), which schematizes the context where (7) was presented:

(9)



Again, as in (9), here, children focus their attention on the “happening” set (fish that was actually caught), and given what is happening there, they reject the argument that the boy didn’t catch a fish since, then, it would not be true (because the boy has indeed caught two fish according to this set).

Note finally that passive constructions do not pose a problem for this account, for it is not syntax-based: If, after an expectation like (5), children say “yes” 50% of the time for the active sentence (6), they should give a “yes” answer around the same percent of the time for the passive counterpart of this sentence, too. In fact, Hulseley et al.’s findings show that this is the case: Children said “yes” around the same percent of the time for active vs. passive sentences. This, again, supports the current account.

As seen, then, the current account does not only capture the apparent Isomorphism effect, documented in the literature, it also captures the conflicting findings of previous research, including those on Dutch where inverse scope interpretations are favored rather than surface. It also accounts for cases where an expectation helps children reach inverse scope interpretations.

The following two sections explain how all this would fit under a Relevance Theoretic account (Sperber & Wilson, 1986/95), as well as the empirical predictions of such an account. First, we start with a definition of the Relevance Theory:

3.2. *Relevance Theory*

On Relevance Theory (Sperber & Wilson, 1986/1995), utterances raise expectations of relevance, but this is not because speakers are expected to obey a Co-operative principle like that of Grice (1989), rather because the search for relevance is a basic property of human cognition.

An input (a sight, an utterance, a memory, etc.), on Relevance Theory, is relevant to an individual when it is related to background information the individual has, and when it helps him or her to make conclusions that matter to him, by means of, for example, answering a question he or she has in mind, setting a doubt, confirming a suspicion, etc. In relevance theoretic terms, an input is relevant to an individual when its processing yields a “positive cognitive effect.”

However, though there are many inputs that could be relevant to an individual (i.e. that could yield a positive cognitive effect), the individual cannot attend to all of them. So, on Relevance Theory, what makes an input worth attending is not just that it is relevant but that it is *more* relevant than any other input available at the time: Other things being equal, the more worthwhile conclusions achieved by processing an input are, the more relevant the input is. In relevance theoretic terms, other things being equal, the bigger the positive cognitive effects achieved by processing an input, the more relevant it is. So, for example, other things being equal, if one is waiting for the bus, the fact that the bus is late is more relevant to him or her than the train being late.

What makes an input worth attending from among the mass of competing stimuli, according to Relevance Theory, is not just the cognitive effect it achieves. In different contexts, the same stimulus may be more or less salient, more or less accessible, etc. In general, the greater the effort of perception, memory and inference required to process an input, the less deserving it will be of one’s attention. In Relevance Theoretic terms, other things being equal, the greater the processing effort required, the less relevant an input is. To exemplify, other things being equal (one is not waiting for the train or the bus), the fact that the train arrives at the station is going to be more relevant to one than the arrival of a bus, for the train is more salient as an object than the bus.

That is, relevance, according to Relevance Theory, is assessed in terms of two factors: (a) effect factor and (b) effort factor. In general, other things being equal, the more (cognitive) effect processing

an input achieves, the more relevant it will be. And the less effort processing an input requires, the more relevant it will be. These two components of Relevance Theory are summarized below in (10):

(10)

- a. Effect factor: Other things being equal, the greater the positive cognitive effects achieved by processing an input, the greater the relevance of the input to the individual at that time.
- b. Effort factor: Other things being equal, the greater the processing effort expended, the lower the relevance of the input to the individual at that time (Wilson & Sperber, 2002: 609).

3.3. Relevance Theoretic Account and Predictions

How does the Relevance Theory, as presented in 3.2., account for our proposal laid out in 3.1 above? Remember that I argued there that in the absence of an expectation involving all members of the universal set, for a sentence like (1), children make their decisions based only on the more salient set of found guys. That is, in Relevance Theoretic terms, in the absence of any expectations of the type mentioned above - or everything else being equal - children make their decisions based on the set whose processing requires less effort (see (10b)).

The idea is, then, that certain information becomes salient. One way for information to be salient is, as in the default case above, for it to be the information that is part of the update, and the more recent the update is, the more salient it is. So, if, at the end of the story, Donald found two guys, this information will be taken as relevant, and the target sentence will be construed in the way that is most relevant to the most recent update of information. Therefore, children's decisions will also be based on what they think the most relevant information is, i.e. that Donald finds two guys. Given this, they will reject the puppet's statement, which they take as the falsification of this information (not the falsification of the less relevant information that there are two guys Donald didn't find).

Another way for certain information to become salient is for there to be certain expectations. Given these expectations, one construes the target sentence in a way that is maximally relevant to the expectation. So if children are presented with the expectation that Donald is supposed to find *all* four guys in context (as opposed to "some guys," "two guys," etc.), but in the end manages to find only two, as in Gualmini's experiments, then, processing the set of unfound guys becomes worthwhile, for it determines the difference between whether Donald achieved his original goal or not. In other words, in Relevance Theoretic terms, taking into account the set of unfound guys, in this case, has greater positive cognitive effects (see (10a)), than the default case where no such expectations are given. It is, thus, worthwhile to attend the set of unfound guys or to the information that there are two guys that Donald didn't find.

This proposal has a number of predictions. For scopally ambiguous sentences that contain negation and an NP with *two* or *some* in object position, as in (1), a Relevance Theoretic account would have the following predictions, out of which, we've already covered the first and the last one:

(11) Predictions for object NPs:

a. Prediction 1: If children limit their focus to the more salient set of "found guys" (or the most recent information update, that two guys were found) out of a set of found vs. unfound guys, then, they should prefer only surface scope interpretations in the absence of any expectations.

→ High effort factor in processing the set of unfound guys

b. Prediction 2: If children limit their focus to salient characters (or to the information which is part of the update), making the "unfound guys" salient should, this time, lead them to an inverse scope interpretation, and to judge (1) true.

→ Decreases the effort factor in Relevance Theoretic terms

c. Prediction 3: Providing an "expectation" which makes the set of unfound guys relevant should similarly help them reach inverse scope interpretations.

→ Increases the effect factor in Relevance Theoretic terms

→ And, to *some* extent, decreases the effort factor, too, by making the set of unfound guys more salient (since the set of *all* guys includes the set of unfound guys.)

In other words, for object NP cases, both making the set of unfound guys more salient (Prediction 2) and providing children with the expectation that Donald is supposed to find all four guys (Prediction 3) should have the same effect: Both should help children reach inverse scope readings. And both do, as indicated by our results for Prediction 2 and Gualmini and Hulsey et al.'s findings for Prediction 3:

3.4. Experiments on Object NPs and Findings

Prediction 1 is supported by the findings of previous research such as Musolino (1998), Musolino et al. (2000); Lidz & Musolino (2002), etc. - cases where no clear expectations were provided to children. Prediction 3 is supported by Gualmini's (2003; 2004) and Hulsey et al.'s (2004) findings, i.e. cases where children were presented with an expectation that involves "all" four elements in context (e.g. the outer circle in (8)). Children reached inverse scope interpretations around 50% of the time when such an expectation was not available, whereas they reached such interpretations 90% of the time when it was made available.

In order to complete the picture laid out in (11) above, we did a pilot study to test Prediction 2 (Özçelik, to appear). We did this by means of two conditions: Condition 1 tested Prediction 1; Condition 2 tested Prediction 2. In both cases, children were tested by using the same method and similar materials as the ones used in previous research. The only difference between the two conditions was in terms of which set was made more salient. For example, for a sentence like (1), presented in a context like (8), it was - as in previous research - the set of "found guys" in Condition 1 and - unlike previous research - the set of "unfound guys" in Condition 2.

The set of unfound guys were made more salient, in Condition 2, by means of letting these two guys jump in happiness, after Donald failed to find them. In particular, the two guys uttered the following: "Yaaaaay!! We are so good at hiding! Yaaaay!" As with most previous research, 4 target sentences (accompanied by 4 stories) in total were used (as well as 4 control sentences, presented in a pseudo-random order). The other three target sentences were: (a) "The pizza guy didn't deliver two pizzas," (b) "The dinosaur didn't eat two pigs," and (c) "The giant shark didn't chase two cows." In Condition 1, the set of unfound/undelivered/non-eaten/non-chased elements were not salient, as in Musolino's (1998) experiments, and children (n = 6) judged these sentences true 48.2% of the time, a number close to that of Musolino (50%). When these sets were made more salient in Condition 2, children's proportion of *yes* answers increased to 77.2%, an appreciable difference.

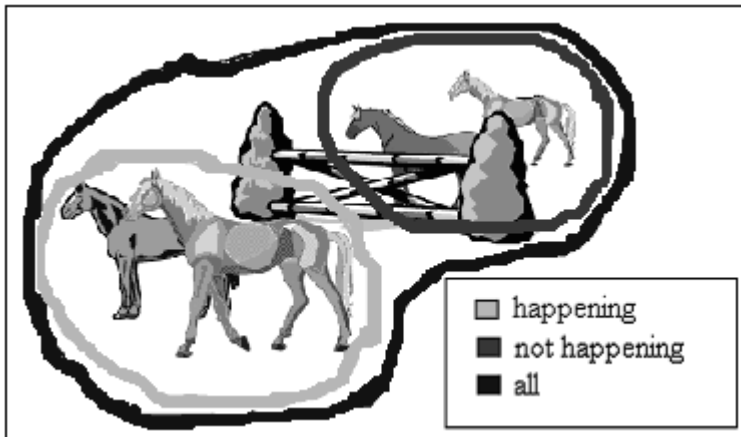
3.5. Experiments on Subject NPs and Findings

The above findings, then, present strong evidence for the current account. However, an alternative account could still be possible, at least for the English facts (if not Dutch): It could be argued that Isomorphism arises as default when the context does not make the set of unfound guys salient enough, or when the context itself is not felicitous, such that no unfulfilling of expectations is present. That is, neither the current account nor a revised version of the Weak Isomorphism account (one revised to accommodate the saliency issue raised here) would be the absolute winner when only English facts are considered (though Dutch facts clearly support the current account).

If, however, the quantified NP is in subject position, as in (12), and in a context like (13), then, it is the *inverse* scope interpretation that corresponds to focusing on the set of "happening" things (or to taking the most recent information update (i.e. that two horses jump) as relevant). That is, if the current account is right, in the absence of any expectations, or in the absence of a more salient "not happening" set, children should be able to reach only inverse scope interpretations. If, however, the Weak Isomorphism account (or a revised version that takes saliency, too, into account) is right, Isomorphism should arise as default in these cases; that is, no matter what, children should interpret (12) on its surface scope reading:

- (12) Two horses didn't jump over the fence. (two > not)
 a. There are two horses that didn't jump over the fence. (two > not → surface: true)
 b. It is not the case that two horses jumped over the fence. (not > two → inverse: false)

(13)



picture adapted from Gualmini (course notes, McGill University)

Again, on the current account, presenting children with an expectation that involves *all* the elements in the universal set or making the “not happening” side more salient would, this time, help them reach surface scope interpretations, not inverse, for it is now the surface scope interpretation which makes the target sentence true. In other words, all the predictions in (11) are now reversed. These predictions are all summarized in (14) for the sentence (12):

(14) Predictions for Subject NPs (Compare with (11)):

a. Prediction 1: If the quantified NP is in the subject position, as with (12), children should, this time, favor “inverse” scope interpretations, not surface, for it is now the inverse scope interpretation which focusing on the set of “happening things” (or the most recent information update) leads one to.

b. Prediction 2: Making the set of “not jumping horses” salient would, this time, help them reach “surface” scope interpretations.

c. Prediction 3: Presenting children an “expectation” that involves “all” four elements in context would, likewise, help them reach “surface” scope.

In contrast, a revised version of the Weak Isomorphism account would expect children to prefer surface scope in all three cases in (14), for, according to this account, the first parse children come up with is always the Isomorphic one. Moreover, since the Isomorphic interpretation (12b) is true here, the bias to access the interpretation that makes the sentence true (Maxim of Charity) also favors the Isomorphic interpretation. That is, there is no competition between the Maxim of Charity and Isomorphism, a perfect situation to choose the surface scope interpretation...

In order to test these predictions, we did a series of experiments. We tested 15 English speaking children between the ages of 5;0-5;7 (mean: 5;1), using the Truth Value Judgment Task (TVJT) methodology. Each subject was tested three times, once for each condition.² Condition 1 tested Prediction 1; Condition 2 tested Prediction 2; and Condition 3 tested Prediction 3.

Participants were placed in an experimental situation where both surface and inverse scope readings of sentences like (12) were possible. Only the surface scope readings (wide scope readings of the quantified NP) were, however, true. An answer of ‘no’ was, therefore, taken as a measure of participants’ ability to access only the inverse scope interpretations.

In each of Condition 1, 2 and 3, children were tested on their interpretation of sentences like (12) (n = 4). The actual sentence uttered by the puppet was the same in each condition. Truth conditions in

² In order to see if there were any contamination effects, the three conditions were not administered in a fixed order. In other words, the order of conditions was different for each child. In order to further prevent any possible contamination effects, there was a 1-week period between each condition for each child, and control stories (n = 4) were different in each condition. Each condition took around 20 to 30 minutes in length.

each story were also the same. What made each condition in each story different was the degree to which the set of “not jumping” horses was made relevant in the story: In Condition 1, which mirrored Musolino’s (1998) and Musolino et al.’s (2000) experiments (though theirs were concerned with object NPs), no special attention was attracted to the set of “not jumping” horses. The story did indeed start, however, by pointing out that it is about “4 horses,” and in the story, in the end, two horses jump and two don’t. (The phrase “two horses” is not uttered anywhere in the story.) At the end of the story, a puppet (a girl) - who watches the story along with the child - utters what she thinks has happened, saying (15):

(15) I know what happened: Two horses didn’t jump over the fence. Am I right?

If the puppet was right, children were instructed to reward her with a candy. If she was wrong, they were supposed to punish her with garbage. If children access inverse scope (non-Isomorphic) interpretations, we would expect them to judge (15) false and give the puppet garbage. If, however, they access surface scope (Isomorphic) interpretations, we would then expect them to judge this sentence true (and reward the puppet), for there are indeed two horses that didn’t jump over the fence.

In Condition 2, children were presented with the same sentences as those used in Condition 1, but this time, the context made the set of “not jumping” horses more salient in order to test Prediction 2.³ As for Condition 3, whose purpose was to test Prediction 3, the stories here mirrored Gualmini’s (2003; 2004) tasks - though his involved object NPs, not subject. Children were, thus, presented with an expectation that *all* four horses are supposed to jump over the fence, but in the end, this expectation goes unfulfilled. The story, again, starts as it does in Condition 1 and 2. This time, however, before the two horses jump, all four horses decide to jump over the fence.

We found that children judged the puppet’s statements true much more often in Conditions 2 and 3 than in Condition 1. The proportion of *yes* answers for Condition 1 was much less than 50%: It was 36.66% if only *yes* answers are considered, and 43.33% if both *yes* and *yes&no* answers are collapsed as *yes*. Children judged the puppet’s statements true around the same percent of the time in Conditions 2 and 3: 60% and 59.66% respectively if only *yes* answers are considered, and 75% and 73% if both *yes* and *yes&no* answers are collapsed together as *yes*. These results are summarized in Tables 1, 2, and 3 below for Conditions 1, 2, and 3 respectively:

Table 1: Results for Condition 1

No	56.66%	n = 15 x 4 = 60 43.3%
Yes	36.66%	
Yes&No	6.66%	

(And 7 children never reached surface scope.)

Table 2: Results for Condition 2

No	25%	n = 15 x 4 = 60 75%
Yes	60%	
Yes&No	15%	

(And only 1 child never reached surface scope.)

Table 3: Results for Condition 3

No	26.9%	n = 13 x 4 = 52 73%
Yes	59.6%	
Yes&No	13.4%	

(And only 2 children never reached surface scope.)

³ This was achieved as follows: One of the not jumping horses says – after two horses have already jumped – that he has a broken leg (one of his legs was indeed covered in bandage), and therefore, that he doesn’t want to jump. After hearing this, the last horse says that it is a good idea, and that he will also stay there with him in order not to leave him alone.

These results support the current account, which argues that in the absence of any expectations involving *all* four horses in discourse (i.e. Condition 3), or in the absence of a more salient set of “not jumping” horses (i.e. Condition 2), children will make judgments based only on the more salient set of “jumping horses,” and will, thus, reject a sentence like (12).

Note that these facts are inexplicable under any version of an Isomorphism account, for, on such an account, children are expected to favor the Isomorphic, surface scope interpretation (12a) since that is the first parse children come up with. Moreover, since the Maxim of Charity also favors the Isomorphic interpretation here, there is no competition between the two biases, and therefore, it should be even easier for them to say *yes*. Since this is not what we found, it follows that an Isomorphic account of these facts is not possible.

Finally, note that children’s justifications are also quite informing. Statements that indicate that the child is aware of the relevance of the two sets (jumping vs. not jumping horses) are made only when they give a *yes* or *yes&no* answer. When they give a *no* answer, they only point out that “they [the two horses] did jump” or that “two horses did jump.” In particular, they do not justify *no* answers with statements like “because of these two horses.” When, however, they give a *yes* answer, they almost always point to the set of “not jumping” horses, saying things like “because of these two,” “because these two horses didn’t jump,” “because these two horses jumped; these two horses didn’t jump.” Notice also that, when justifying their answers, most children refer to the two relevant objects with a ‘definite’ form of reference. All these seem to support the current account; when children give a *no* answer, it is because they don’t view the “not happening” set relevant.

4. General Discussion and Conclusions

Children, then, do not favor surface scope interpretations. Rather, they favor interpretations that correspond to the set that seems to be contextually more relevant (less effortful, more cognitively effective, etc.) to them, and in doing so, they rank saliency higher as a cue for general relevance than the Maxim of Charity. This, then, is the only difference between children and adults!

This point seems to be further supported by children’s *yes&no* answers (see Tables 1, 2, 3) and their justifications of such answers: In justifying these answers, they made, almost all the time, a statement like “because these two horses jumped; these two horses didn’t.” This shows that, in addition to those children who abide by the Maxim of Charity, there are some children who do not do so, for they do not simply judge a given sentence true, but rather point out that the sentence is both true and false (by giving the puppet both candy and garbage). In other words, when they are aware of the fact that both of the interpretations are possible, they do not always give the benefit of the doubt to the speaker and accept the sentence. That is, it is perhaps too generous to believe the common assumption that children, too, favor the interpretation that makes a statement true (Crain & Thornton, 1998).

This point raises a number of additional questions: First, previous research seems to have overestimated the bias to choose the interpretation that makes a sentence true when two interpretations (true and false) are available. In other words, when children give the answer *no* to a scopally ambiguous sentence, for which both *yes* and *no* answers are available, one should not perhaps automatically conclude that their grammar does not have the interpretation that makes the sentence false (e.g. the inverse scope interpretation in the case of Musolino (1998), Musolino et al. (2000), Musolino & Lidz (2002), etc.). This means that even when children perform differently from adults in TVJTs, that does *not* necessarily mean differences in grammar between the two groups.

One conclusion that can be drawn from the results of this study is, then, that children have the knowledge of the covert movement operation leading to the non-Isomorphic interpretation although this is impossible to learn based on input, suggesting that it is provided by UG.

Another possible interpretation is, however, that these NPs are not in fact quantificational to begin with! After all, in the default case, both for quantified NPs in object and subject position, children favor the interpretation where the quantified NP takes narrow scope over negation (corresponding to surface scope in the case of object NPs like (1) and inverse scope in the case of subject NPs like (12)). That is, it could be that these NPs are free variables (instead of being quantificational), and for free variables, the existential has to be below negation, possibly because existential closure has to be at the VP-level (nuclear scope), resulting in the requirement that they cannot take wide scope over negation (since VP is below negation). This possibility was never taken seriously by previous research, perhaps

because no studies have so far found that the narrow scope interpretation is favored even when these NPs are in subject position (though even the fact that object NP cases are interpreted with narrow scope, by itself, makes this as much of a possibility as the Isomorphism account). So far, only Lidz & Musolino (2005/2006) looked at subject NP cases like (12), and argued that children interpret these, too, with surface scope. But they presented their participants an expectation that involves all members in context! Therefore, the current study is the only one that tests children's interpretation of subject NP cases, such as (12), in the default case, too, i.e. Condition 1. This condition is very important since this is the condition which mirrors the experimental setting of those studies which found the Isomorphic results with object NP cases.

Thus, a comparison between object and subject NP cases is now possible on fair grounds. And the results of such a comparison is in line with the predictions of the current account, which are outlined in (11) vs. (14): Children favor surface scope in the default case with object NPs, but inverse scope with subject NPs (Predictions 1). However, when they are given an expectation of the type mentioned above (Predictions 3) or a more salient set of "not happening" items (Predictions 2), they reach inverse scope with object NPs and surface scope with subject NPs. In other words, if one takes Lidz & Musolino's (2005/2006) findings as representative of the whole subject NP cases, and compares this with object NP cases in previous research - as has often been done - an incomplete picture will emerge, where children favor surface scope interpretations across the board. We showed, in this paper, that this is not the case.

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