

# Italian children must not be born in the USA

## A research proposal challenging Unique Scope Assignment

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### KEYWORDS

Language Acquisition  
Unique Scope Assignment  
Question Answer Requirement  
Truth Value Judgment Task

### ABSTRACT

When acquiring language, sentences with two logical operators (such as negation, quantifiers and modal verbs) have been shown to be interpreted differently by children and adults. Gualmini et al. (2008) have pointed out that the Question Answer Requirement plays an important role in children's ability to access the adult-like interpretation of sentences containing a negation and a quantifier. Moscati et al. (2016) argue that this requirement does not play a role in the acquisition of modals. They suggest that there is a Unique Scope Assignment (USA) stage in which children are only able to access the strong reading: the interpretation yielding the smallest set of possible situations. A combination of a critical review of their study and the discussion of findings in a unpublished study lead to the hypothesis of the current paper that a USA stage might not be necessary to explain the results of Moscati et al. (2016) if children's limited processing capacities are taken into account. A variation of Moscati et al.'s experiment is proposed to test this hypothesis.

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## 1. Introduction

An important challenge in the interpretation and acquisition of language is that utterances can be ambiguous. The example in (1) below can be interpreted as both (1a) and (1b).

- (1) Every horse didn't jump over the fence. (Musolino, Crain, & Thornton, 2000, p. 11)
- a. For each of the horses, it is the case that they did not jump over the fence. ( $\forall > \neg$ )<sup>1</sup>
- b. Some, but not every horse jumped over the fence. ( $\neg > \forall$ )

When hearing such a sentence, the hearer must distinguish which of the two interpretations applies in the situation the speaker refers to. This is especially difficult for children, who are still in the process of discovering what certain linguistic structures can and cannot mean. The current study investigates the ambiguity of Italian sentences containing negation (as in the example above) and a modal verb (such as *can*). Although previous research (Moscati et al., 2016) suggests that children are unable to access both interpretations, the present research argues that they can and proposes an experiment to test this hypothesis.

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<sup>1</sup> This notation exemplifies which operator takes scope over (>) which in the paraphrased interpretation, using the following symbols to refer to the operators:  $\forall$ : universal quantifier,  $\neg$ : negation,  $\diamond$ : modal *can*,  $\circ$ : modal *must*

## 2. The acquisition of scope ambiguity

The ambiguity of the sentence in (1) arises from the presence of two logical operators, which can take scope over each other. For the interpretation in (1a), the universal quantifier is interpreted to take wide scope over the negation. For (1b), the negation takes scope over the quantifier, resulting in the narrow scope reading of the universal quantifier. Various studies (e.g. Lidz & Musolino, 2002; see also Musolino et al., 2000) have shown that children have trouble accessing both interpretations of sentences containing two logical operators, sometimes even having a preference for a reading that is ungrammatical for adults (cf. Musolino et al., 2000; Moscati et al., 2016). This has led several researchers (Lidz & Musolino, 2002; Musolino et al., 2000) to conclude that children access the isomorphic interpretation, in which the surface structure overlaps with the logical interpretation. For example, they argue that children interpret the sentence in (1) as (1a) because the order of the operators is the same as in the overt order of the sentence, with the quantifier preceding, and thus isomorphically taking scope, over the negation.

Although the isomorphic interpretation was first considered the only interpretation children are able to access, Musolino and Lidz (2003; 2006) demonstrated that adults and five-year-old children both have strong preferences for one of the two readings of sentences with both a quantifier and negation. Importantly, they show that this preference can be overridden by contextual factors. This suggests that the difference between adults and children is not merely due to their syntactic knowledge, but also their processing and pragmatic abilities. Gualmini (2004) argues that children were unable to access the non-isomorphic interpretation in previous experiments because this interpretation was not appropriate (i.e. felicitous) in the context of the experiment. Children are more sensitive to these felicity conditions than adults, resulting in an asymmetry in their interpretations. Using a Truth Value Judgment Task (TVJT) similar to previous studies, the authors show that four- and five-year-olds can access the non-isomorphic interpretation of sentences with a negation and *some* if it is felicitous in the context. Gualmini et al. (2008) suggest that the crucial factor in these experimental designs is the Question-Answer Requirement (QAR). The QAR assumes that both children and adults interpret all statements as answers to a question that is made salient in the discourse (p. 213). The latter is referred to as the Question Under Discussion (QUD). An interpretation is a good answer to the QUD if and only if it entails a member of the set of positive and negative answers to the QUD. Gualmini et al. (2008) show that if the non-isomorphic interpretation satisfies the QAR, three- to five-year-old children perform similar to adults on a TVJT testing their ability to access this interpretation of negated sentences with respective *two* and *every*.

To explain the differences between children and adults, Gualmini et al. (2008) stress the importance of the Principle of Charity. According to this principle, hearers will select the interpretation that makes a sentence, ambiguous or not, true (p. 208). This is why adult English speakers will judge the sentence in (1) above

to be true in different situations: even though there exists an interpretation in which the sentence does not correctly describe the situation, it is interpreted in the way that makes the sentence true. In the case of a sentence with two logical operators, if the interpretation that is a good answer to the QUD yields a false description of the situation, adults can establish a new QUD and assign a different scope. Children, on the other hand, have not developed the ability to discard the current QUD and accommodate a different one, although it is unclear what causes this deficit. Gualmini et al. (2008, p. 30) propose that it might be due to children's "egocentrism", which makes it difficult for them to realize that the speaker's QUD is different from the one they assumed. However, findings from a study by Viau et al. (2010) suggest that the inability to establish a new QUD is caused by children's limited processing capacities. Children who were primed to access the non-isomorphic interpretation were also able to assign inverse scope in sentences in which the pragmatic conditions did not require this interpretation. Thus, it is possible that children's limited cognitive capacities cannot manage the processing load of establishing a new QUD and accessing inverse scope. However, priming the inverse scope interpretation facilitates the processing of scope inversion and enables children to access the interpretation that yields the sentence true. Since adults' cognitive abilities are more developed, scope inversion is less difficult for them, allowing them to access both interpretations in order to adhere to the Principle of Charity.

### 3. The acquisition of ambiguity with modals

The effect of scope ambiguity on sentences containing modals has also drawn much attention in language acquisition research. Since a modal verb, like a quantifier, is a logical operator, sentences containing a modal verb and negation can give rise to ambiguity. Moscati and Gualmini (2008) show that Italian-acquiring children strongly favour one scope assignment, in this case the inverse scope reading in which the negation takes wide scope over the modal<sup>2</sup>. Given Gualmini et al.'s (2008) theory on the QAR, Moscati and colleagues set out to investigate whether this requirement also improves children's performance on sentences containing modals. In a first study, Moscati (2011) did not find any effect of a manipulation of the QUD on children's interpretation of the sentence. However, due to some flaws in that research, Moscati and colleagues (2016) set up an improved study to assess children's knowledge of the narrow scope reading. After a story describing a situation in which Fred can choose to drive the bike or the car, children were asked to assess the sentence in (3) as an answer to the explicit QUD in (2).

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<sup>2</sup> This is opposite from what the observation of isomorphism suggests, but is argued to be due to the fact that this is the strongest reading, rendering the smallest set of possible circumstances true (see e.g. Koring et al., 2018). This would also explain how children can learn from positive evidence only. Since the distinction between isomorphism and strong vs. weak readings is not the topic of the present study, it will not be elaborated here.

- (2) Fred deve guidare la moto?  
'Must Fred drive the bike?'
- (3) Fred può non guidare la mot  
Fred can.MOD NEG drive the bike.
- (4) a. Fred is allowed not to drive the bike. ( $\diamond > \neg$ )  
b. \*Fred is not allowed to drive the bike. ( $\neg > \diamond$ )

Only the narrow scope reading in (4a) is grammatical for adults, but children prefer the wide scope reading in (4b). Although children performed similar to adults on sentences with quantifiers, they rejected the sentence in (3) as an answer to (2) much more often than adults, revealing that the QAR does not explain children's behaviour in these sentences. Moscati et al. therefore propose a Unique Scope Assignment (USA) stage for modals during which children are only able to access the scope yielding the strongest interpretation.

There are a few problems with the Moscati et al. (2016) study. First of all, they explain the performance differences between children and adults by proposing a two-stage model of children's acquisition of scope assignment, analogous to the framework of Optimality Theory (cf. Hendriks & Spenader, 2006). Moscati et al. suggest that for adults the Principle of Charity is more important than the QAR, while the opposite is true for children. However, this leads to some questionable predictions. Firstly, it suggests that adults will accept the interpretation that makes the sentence true, regardless of whether they answer the QUD. Despite the QUD being implicit in Gualmini et al.'s study (2008), some adults only accessed the (ungrammatical) interpretation that answered the QUD, as they rejected a particular sentence. Thus, they ignored the Principle of Charity, which could have been adhered to if a new QUD had been established. A processing account children and adults' preference for an isomorphic interpretation predicts this pattern. According to the Principle of Least Effort (Zipf, 1949), processing costs will be minimized in producing and interpreting a sentence. Depending on how much effort hearers are willing to spend, they will either establish a new QUD and access inverse scope, or disregard the Principle of Charity (and the ungrammaticality) and reject the sentence. Secondly, the relative importance of the Principle of Charity and the QAR predicts that children will accept the surface scope interpretation, even if their preferred inverse scope interpretation is true, but not an answer to the QUD. However, this also does not hold. Viau et al. (2010) show that children are able adhere to the Principle of Charity, regardless of whether that interpretation answers the implicit QUD. Thus, the Optimality Theoretic approach to explaining the differences between children and adults should be rejected. Children's inability to access inverse scope in situations where that interpretation adheres to the Principle of Charity, but requires a different QUD, is more likely to be due to their limited processing capacities.

Moscato et al. (2016) admit that children's inability to accommodate a new QUD could also be ascribed to processing capacities, but they do not discuss how this might have affected the findings of their research. However, this is precisely what may have confounded their results. Both in their study, as well as in Moscato (2011), the target sentences contained the Italian modal *potere*. However, this verb can signify both POSSIBILITY and ALLOWANCE, yielding four possible interpretations as shown in (5) and (6).

- |     |  |         |
|-----|--|---------|
| (5) | a. It is possible for Fred not to drive the bike.  | (♦ > ¬) |
|     | b. *It is not possible for Fred to drive the bike. | (¬ > ♦) |
| (6) | a. Fred is allowed not to drive the bike.          | (♦ > ¬) |
|     | b. *Fred is not allowed to drive the bike.         | (¬ > ♦) |

Moscato et al. state that they use the English translation that, according to them, is most appropriate for the context. Thus, in the experimental materials they gloss *potere* for the POSSIBILITY meaning like in (5). However, a closer inspection of the stories suggest that both POSSIBILITY and ALLOWANCE are relevant to the situation. For example, in the first story, Fred can choose to go by bike or by car. However, Smurfette thinks the bike is dangerous.<sup>3</sup> This does not only challenge the true availability of this option, but also raises the question whether Fred is allowed to go by bike. The ambiguity of *potere* will increase the processing load of interpreting the sentence in (3). When children notice that the wide scope POSSIBILITY reading in (5b) is not true in the context, the Principle of Charity will prompt them to look for another interpretation. Assuming that children also follow the Principle of Least Effort, they will first consider the ALLOWANCE meaning of *potere* in before they try to inverse scope, which is cognitively more demanding. Although the truth value of (6b) is disputable, children's limited processing capacities makes them unable to check the narrow scope reading of the negation and are therefore unable to access an interpretation that yields (3) true.

Because the native Italian authors felt that an answer that contains the same modal verb as in the question is easier to process (Moscato et al. (2016)), they performed a second experiment in which they only changed the QUD to (7) below.

- (7) Fred può non guidare la moto?  
'Can Fred not drive the bike?'

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3 In two of the three stories, the only available option (e.g. the bike) at the beginning of the story is discredited in some way. It is unclear why the authors included this, but they might have done so to make the other option more salient or validate its presence. However, in the third story, both options are equally plausible. This story also yielded the highest number of correct responses on average in the two experiments, possibly because the ALLOWANCE meaning of *potere* was less salient in this story. However, the by-item variation was quite high, so it is difficult to draw firm conclusions.

However, regardless of the ambiguity of *potere*, there is a different problem with this design, namely the ambiguity of the QUD to Italian-acquiring children. The possible interpretations of the QUD, as well as the sets indicating the respective positive and negative answers for each interpretation, is given in (8). The English translation that the authors give, (8a), is the only interpretation that is possible for adult speakers of Italian.<sup>4</sup> However, as children have difficulties with accessing the scope rendering the adult interpretation, it is very likely that they will interpret the sentence as in (8b), with the negation taking scope over the modal.

- (8) Fred può non guidare la moto?  
 a. Is it the case that it is possible for Fred not to drive the bike? ( $\diamond > \neg$ )  
 $\{\diamond \neg, \neg \diamond \neg (= \circ)\}$   
 b. \*Is it the case that it is not possible for Fred to drive the bike? ( $\neg > \diamond$ )  
 $\{\neg \diamond, \neg \neg \diamond (= \diamond)\}$

Since children interpret the puppet's answer in (9) as (9b) and the story suggests that it is possible for Fred to drive the bike, children will conclude that the sentence in (9) is not true.

- (9) Fred può non guidare la moto.  
 a. It is possible for Fred not to drive the bike. ( $\diamond > \neg$ )  
 b. \*It is not possible for Fred to drive the bike. ( $\neg > \diamond$ )

As this violates the Principle of Charity, children might now try to switch scope to the weak reading, accessing the narrow scope reading in (9a). However, this interpretation is not a good answer to the child's interpretation of the question as shown in (8b), since it does not entail either member of the set of answers given in (8). Their processing capacity is not developed enough to then also inverse the scope of the negation in the question. Children will therefore consider (9b) to be the correct interpretation of an answer to (8b) and judge the puppet's answer to be false. To conclude, children's inability to access the narrow scope reading in either of Moscati et al.'s (2016) experiments is not only caused by the ambiguity of the puppet's answer, but also by the ambiguity of the QUD for children. This suggests that a stage of Unique Scope Assignment might not be necessary to explain the results of their study on the acquisition of modals by Italian-acquiring children.

An unpublished study by Otten (2018) shows that children acquiring Dutch are able to access the narrow scope reading of the negation in a sentence containing the modal, even though they, nor adult speakers of Dutch, prefer this interpretation. This indicates that the Unique Scope Assignment does not exist for Dutch children. Otten suggests that her findings are different from Moscati et al.'s (2016), because of linguistic differences between Italian and Dutch. Both the nar-

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4 For simplicity's sake we will assume here that the POSSIBILITY meaning of *potere* is the only interpretation.

row and wide scope reading of the negation are grammatical in Dutch, but not in Italian. Still, this suggests that it should be easier for Italian-acquiring children to learn that the interpretation they prefer is ungrammatical, since Dutch-acquiring children receive no evidence that the strong reading is wrong. As discussed above, the ambiguity of *potere* could have confounded the results from Moscati et al. (2016), so a USA stage might not be necessary for Italian either. Since Dutch *moeten* does not have two meanings, it facilitates the processing of scope inversion. This is why Dutch-acquiring, but not Italian-acquiring children, seem to be able to access both interpretations.

#### 4. The current study

Sentences containing two logical operators have been shown to be notoriously difficult for children. Studies investigating children's ability to assign scope should take into account that the target interpretation should be a good answer to the Question under Discussion (Gualmini et al., 2008). Moscati et al. (2016) argue that this requirement does not play a role in the acquisition of modals, but that there is a Unique Scope Assignment stage in which children are only able to access the strong reading. However, a critical review of their study and Otten's findings (2018) suggest that such a stage might not be necessary to explain their results. If the difference between children and adults' interpretation of sentences with two logical operators is due to children's limited processing capacities, then Moscati et al. (2016)'s findings might have been confounded by the high processing load of the ambiguous modal *potere*. The following research question will therefore be investigated in the current study:

Are Italian-acquiring children able to access the narrow scope reading of sentences containing a modal and negation?

It is hypothesized that Italian-acquiring children have access to the both the wide and the narrow scope interpretation of the negation in sentences with a modal. If the pragmatic conditions are satisfied and the modal is not ambiguous, they are expected to be able to confirm the narrow scope reading of the negation in a sentence that also contains a modal.

### 5. Method

#### 5.1 Participants

Similarly to Moscati et al. (2016), thirty monolingual normally developing Italian-acquiring children will participate in the study. They will be between 4;6 and 6;0 years old. Ten adult native speakers of Italian will serve as controls.

#### 5.2 Materials and procedure

Instead of *potere* (Moscati et al., 2016), the present study will investigate the modal *dovere*. It indicates OBLIGATION, as can be seen in (10) below. This sentence is not ambiguous for Italian-speaking adults, as they only have the interpretation in (10a). Children, on the other hand, prefer the negation to take wide scope over the modal as in (10b).

- (10) Cip e Ciop devono non mangiare una mela  
 Chip and Dale must.MOD NEG eat an apple.  
 a. It is obligatory for Chip and Dale to not eat an apple. ( $\bigcirc > \neg$ )  
 b. \*It is not obligatory for Chip and Dale to eat an apple. ( $\neg > \bigcirc$ )

A QUD that examines ALLOWANCE can only be answered by the narrow scope reading of OBLIGATION, whereas the wide scope interpretation does not entail a positive or negative answer to such a QUD.

- (11) Are Chip and Dale allowed to eat an apple?  $\{\diamond, \neg \diamond\}$

Only the interpretation in (10a) is a good answer to the QUD in (11), as it entails the negative member of the set of answers. The reading in (10b) implicates a positive answer to the question, but since children's pragmatic abilities have not fully developed, they might not be aware of this. They will therefore think that (10b) does not satisfy the QAR. Recall that the Italian verb signaling ALLOWANCE, *potere*, is ambiguous, because it also indicates POSSIBILITY. Unlike in Moscati et al. (2016), the QUD will not be explicit in this study, as this ambiguity might confuse children. An implicit QUD has been shown to affect children's interpretation of sentences containing two logical operators before (e.g. Gualmini et al., 2008), so it was deemed sufficient for the purposes of this study.

The procedure will be as follows. The experimenter will tell the child that she is going to tell some stories and that the child and the hand puppet, who is handled by a different experimenter, have to pay attention, because she will ask some questions about the story at the end. However, the hand puppet is very sleepy, so the child has to help him by judging whether his answer is correct. If so, the child can give a candy to the puppet. However, if the puppet has given a wrong answer, the child can give him a cup of coffee to help him stay awake and pay attention next time.

The following story will then be acted out, which was created to establish the implicit QUD in (11) and contain the target sentence in (10):

*Chip tells Dale that he threw a beech nut on Mickey Mouse yesterday. "Oh", says Dale, "I'm much naughtier than you! I made Minnie trip yesterday!" They then decide to have a competition who of them is the naughtiest. The first of them who does something naughty will win. Then Donald Duck comes in. He places a bowl of apples on the table and says:*

Cip e Ciop devono non mangiare una mela.

'Chip and Dale must not eat an apple.'

*Donald Duck leaves the house. Chip hops to the bowl of apples, grabs one and eats it.*

The experimenter will then ask the hand puppet whether he has fallen asleep and tell what happened. The setup with the sleepy puppet prevents the final question from being infelicitous. If the child thinks that there is no resolution to the story yet



(e.g. think that neither Chip nor Dale has won yet), it would be infelicitous to end the story and ask the puppet what happened. However, because the experimenter thinks the puppet has fallen asleep, he can ask the question to find out whether the puppet has indeed not fallen asleep.

The puppet's answer to the final question about the example story above, will be along the following lines:

(12) I know what happened: Chip has won the competition.

If the child thinks the puppet's answer is correct and gives the puppet a candy, then he or she must have interpreted the target sentence as the narrow scope reading in which Chip was obligated to not eat the apples. If the negation was assigned wide scope and the target sentence was interpreted as in (10b), neither Chip nor Dale has won the competition yet, because there was no restriction on eating the apples or not. The child will deem the puppet's answer incorrect and give the puppet a cup of coffee to help him pay attention next time. Afterwards, the child will be asked why the puppet's answer was correct or incorrect, to examine whether used the target sentence to judge the puppet's answer.

The experiment will contain eight trials in total. In two trials, the target sentence contains a modal and negation and the puppet answers correctly according to the adult interpretation. These are the experimental trials in which the child is hypothesized to access the narrow scope interpretation, unlike the predictions of USA. To control for a yes-bias, there will also be two trials with the same target sentence, but an incorrect answer from the puppet. Finally, there will be a control condition in which the target sentence does not contain negation. In two of the four trials in this condition, the puppet's answer will be correct and in the other two it will be incorrect. The procedure will be similar for adults, except that they only have to say whether the puppet's answer is true or false, without giving him coffee or candy.

## 6. Discussion and Conclusion

The experiment described above was proposed in order to investigate whether Italian-acquiring children can access the inverse scope reading of negation in sentences containing modals. Previous studies investigating children's acquisition of these sentences found no evidence for children's ability to do so (Moscati, 2011; Moscati et al., 2016). However, a critical review of this latter study showed that other factors might have confounded their results. In addition, an unpublished research (Otten, 2018) suggests that Dutch-acquiring children do not go through a USA stage as Moscati et al. (2016) suggest for children acquiring Italian. Therefore, the hypothesis of this study was that children can access both readings if the confounding factors of previous studies are eliminated. More specifically, it is expected that children will confirm the puppet's answer in the experimental conditions, showing that they must have interpreted the target sentence with the modal taking scope over the negation.

The present research assumes that children's inability to establish a new QUD is due to their limited processing capacity. However, this hypothesis needs to be investigated further to see how children learn to handle this problem when they grow up. Does their language competence become more adult-like because their capacity increases or because the accommodation of a different QUD requires less processing costs? In addition, it would be interesting to see if a priming experiment as in Viau et al. (2010) could enable Italian-acquiring children to access the narrow scope reading of the negation in a sentence containing *potere*. However, this can only be done if the hypothesis of the current study is confirmed.

### Acknowledgments

I want to thank Luisa Meroni for her feedback on earlier versions of this manuscript. Many thanks also to two anonymous reviewers for their insightful comments. In addition, I am grateful to Beatrice Bancheri for her help with the Italian modals and checking the translations and glosses. Any remaining errors are of course my own. ■

*Received December 2019; accepted February 2020.*

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