

# On that *One* Poverty of the Stimulus Argument\*

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## Abstract

This paper examines the logical problem of language acquisition drawing upon an experimental study on children's knowledge of anaphoric *one* by Lidz, Waxman and Freedman (2003). The finding was that, upon being presented with the instruction "Look! A yellow bottle. Do you see another one?", 18-month-old children prefer to look at a yellow bottle rather than to a bottle of a different color. According to Lidz et al. (2003), the results that children cannot interpret *one* as anaphoric to head nouns. We point out that the experimental findings are not explained under the hypothesis offered by the authors of that study. Secondly, we consider whether, under current assumptions, children's knowledge of anaphoric *one* can be inferred from the properties of the final state. Thirdly, we reaffirm the validity of the Poverty of the Stimulus argument, despite the challenge posed by the learning model proposed by Regier and Gahl (2004). Finally, we draw upon recent psycholinguistic work to propose an explanation for the findings documented by Lidz et al. (2003) that is independent from – though consistent with – their knowledge of the constraint on anaphoric *one*.

## 1. On that *One* Experiment

This paper is concerned with the acquisition of anaphoric *one* as a case study for the Poverty of the Stimulus argument. Consider the examples below, due to Baker (1978).

- (1) \*The student of chemistry was more thoroughly prepared than the one of physics
- (2) The student with short hair is taller than the one with long hair

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In order to account for the contrast above, Baker (1978) argued that *one* cannot be anaphoric to the head noun N° (see also Hornstein and Lightfoot, 1981). Thus, sentence (1) is ungrammatical because *one* has targeted the head noun *student* and not the N' *student of chemistry*. By contrast, (2) is acceptable, because the relevant prepositional phrase is an adjunct rather than a complement. Prepositional adjuncts like *with short hair* introduce a second N' element; hence *one* can target an N' that excludes the prepositional phrase, namely the lower N'.

The properties of anaphoric *one* were used by Baker (1978) and Hornstein and Lightfoot (1981) as a case study for the Poverty of the Stimulus argument. Baker (1978) and Hornstein and Lightfoot (1981) highlighted the mismatch that exists between a child's experience and his linguistic competence. In order to evaluate this claim, Lidz et al. (2003) attempted to provide an explicit characterization of the child's experience and linguistic competence.

Before we consider the Lidz et al. study, one caveat is in order. For expository purposes, we will adopt here the syntactic structure and the characterization of anaphoric *one* assumed by Lidz et al. (2003). More specifically, along with Lidz et al. (2003), we will assume that determiners occur in the specifier of NPs, rather than as the heads of a Determiner Phrase (see Abney, 1987). Similarly, with Lidz et al. (2003), we will assume that the behavior of anaphoric *one* can be described by the following constraint: *one* cannot be anaphoric to a head noun N°. Both of these assumptions are controversial. In particular, the literature offers several alternative accounts of anaphoric *one* (see Llombart-Huesca, 2002; Panagioditis, 2003; Schuetze, 2001 a.o.). For present purposes, it does not seem necessary to dwell on the issue. Assuming that there is a constraint, the issue is whether that constraint is innately specified or learned on the basis of experience.

Lidz et al.'s contribution is two-fold. Firstly, in order to characterize the primary linguistic data, Lidz et al. (2003) performed a corpus analysis of the parental speech to Adam (Brown, 1973) and Nina (Suppes, 1974) from the CHILDES database (MacWhinney, 2000). Secondly, they conducted an experiment using the intermodal preferential looking paradigm (see Spelke, 1979 and Golinkoff, Hirsch-Pasek, Cauley and Gordon, 1987).

The experiment conducted by Lidz et al. (2003) was designed to answer the question of whether "infants know that *one* is anaphoric to the phrasal category N' and thus that the NP has a hierarchical (rather than flat) structure" (Lidz et al. 2003; p. B69). 24 English-speaking 18-month-old children were tested and the experiment consisted of two phases. In the familiarization

phase, children watched the image of a single object on a monitor (e.g., a yellow bottle). At this stage, children only heard ‘neutral’ descriptions such as “*Look! A yellow bottle.*” Following the familiarization phase, children were presented with a testing phase in which pairs of images were shown on the monitor (e.g., a yellow bottle and a blue bottle). The linguistic stimuli that accompanied this display differed depending on the condition to which children had been assigned. Children in the control condition heard “*Now look. What do you see now?*”, whereas children in the anaphoric condition heard “*Now look. Do you see another one?*”. The control condition allowed the experimenters to determine whether subjects have any reasons to prefer looking at one particular object when either object can be the intended referent, as far as linguistic information goes. The crucial case is the anaphoric condition. This is what Lidz et al. (2003; p. B70) say:

“if infants represent the NP with flat structure, and therefore interpret *one* as anaphoric to the category  $N^{\circ}$ , then both images would be potential referents of the noun (bottle). In this case the linguistic stimulus is underinformative with regard to the test images, and so infants should reveal the same pattern of performance as in the control condition.”<sup>1</sup>

The finding documented by Lidz et al. (2003) is that, in the anaphoric condition (i.e., “*Look now. Do you see another one?*”), subjects did not behave at chance. In the anaphoric condition, subjects looked at the familiar object (i.e., the yellow bottle). The conclusion drawn by Lidz et al. (2003; p. B72) is that:

“In the domain of anaphoric reference, learnability considerations lead to the conclusion that learners never consider the possibility that an element could be anaphoric to  $N^{\circ}$ . (...). This logical conclusion is now supported by corpus analysis and by experimentation with infants.”

Similarly, Lidz and Waxman (2004; p. 165) claim that:

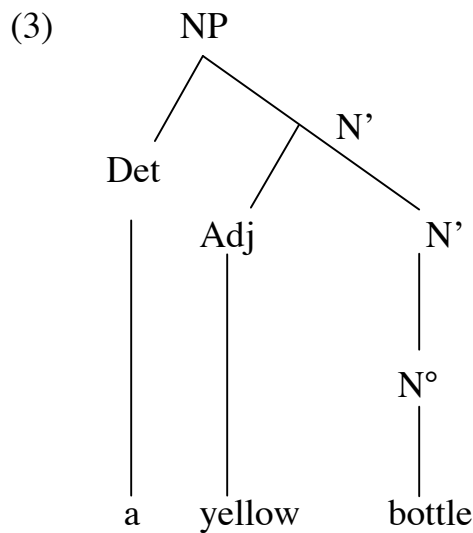
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<sup>1</sup> Alternatively, one could claim that children will respond in the same way they would respond to an instruction like “*Now look. Do you see another bottle?*”. To find out how children would respond to such an instruction, one only needs to look at the control experiment presented by Lidz et al. (2003): children respond at chance (i.e., they take either object to be a possible target).

“By the time they are 18-months old, infants have an articulated, nested, structure for the Noun Phrase and they know that *one* can be anaphoric only to phrasal categories.”

In our view, this conclusion does not follow from the experimental evidence presented by Lidz et al. (2003). Furthermore, even if we credited children with knowledge of the properties of anaphoric *one* (on independent grounds), there would still be no explanation for the experimental findings.

In analogy with the tree diagram used by Lidz et al. (2003), we can take the phrase structure of the noun phrase *a yellow bottle* to be the following.



The structure in (3) contains two N’s. This is because the phrase structure rule that allows the insertion of an adjective can be repeated (in order to generate noun phrases containing more than one adjective such as *the big yellow bottle*) (see Lidz and Waxman, 2004). Assuming that *one* targets N’s, either N’ is a suitable target. The acceptability of (4) and the ambiguity of (5) depend on either N’ being able to serve as a target.

(4) John has a yellow bottle and I have a blue one

(5) John has a yellow bottle and I have another one<sup>2</sup>

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<sup>2</sup> An anonymous reviewer expresses doubts about the presence of an ambiguity in (5) (see Lidz and Waxman, 2004 for the claim that an ambiguity is present). There is no question that associating *one* with the lower N’ is a much dispreferred option. Nevertheless, if it turned that (5) is unambiguous, this fact would not be explained by the generalization in (6). In other words, as far as the generalization under consideration is concerned, we must assume that both N’s are potential candidates for anaphoric *one*. This does not mean that

The consequence of the phrase structure in (3) for the experiment is that, upon hearing a sentence like “*Look now. Do you see another one?*”, even children who have knowledge of the relevant constraint could interpret it to mean “*Do you see another bottle?*” just like they could interpret it to mean “*Do you see another yellow bottle?*”. Given that either N’ is a suitable antecedent for anaphoric *one*, the question is: what should subjects do when two N’s are available? The answer is very simple: we don’t know.

The relevance of the syntactic structure in (3) for the experiment was overlooked by Lidz et al. (2003). In describing the design of their experiment Lidz et al. (2003; p. B70) write:

“if infants represent the NP with a nested structure, and interpret *one* as anaphoric to N’, then they should reveal a preference for the (only) image that is picked out by N’ (the yellow bottle).”

As we saw, the syntactic structure that Lidz et al. (2003) give us contains two N’s; there is no single object corresponding to ‘the (only) image that is picked out by N’.’ As far as we know, the experimenter has no way of predicting the behavior of a subject who knows the properties of anaphoric *one*.

We seem to have reached an impasse. Part of the problem comes from the fact that Lidz et al. (2003) and Lidz and Waxman (2004) conflate two different issues: (i) knowledge of the internal structure of Noun Phrases and (ii) knowledge of the constraint on anaphoric *one*. As it turns out, the experimental evidence is consistent with the existence of an intermediate level N’ in children’s noun phrases, which can be targeted by anaphoric *one*. By contrast, despite Lidz et al.’s and Lidz and Waxman’s claim, the experimental results do not support children’s knowledge of the properties of anaphoric *one*.

In light of the discussion above, one might ask whether the experimental results could provide evidence against children’s knowledge of the constraint on anaphoric *one*. To illustrate, consider the syntactic structure in (3). Given that there are two N’s and children could take either N’ as the antecedent of *one*, we should expect chance behavior. But we do not see chance behavior. Thus, it could be argued that the data offered by Lidz et al. (2003) provide evidence against children’s knowledge of the properties of anaphoric *one*.

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there can’t be other factors that make the upper N’ the preferred option. We will consider some of these factors in the concluding section of the paper. For the time being, this means that Lidz et al.’s findings suggest that young children have access to the mechanism of ambiguity resolution that explains the preference of the upper N’, whatever that mechanism might be.

This would also be inaccurate, however. In particular, this reasoning is flawed on two counts. First of all, this reasoning assumes that the two N's are equally accessible. Given what we know about ambiguity resolution, it would be very surprising if children had no (linguistic or non-linguistic) reasons to prefer one reading of the relevant question over the other. Second, suppose for the sake of the argument that in the present case the two readings were indeed equally available. It still remains unclear how a subject should behave. In fact, equal probability in selecting either N' in the syntactic representation does not translate as equal probability in looking at either object, because one reading of the question posed to subjects is associated with only one object in the visual display and the other reading is associated with two objects in the visual display. If children select the upper N', they should look at the yellow bottle; if children select the lower N', they could look at either bottle. This makes it difficult to establish what would count as chance behavior in the present experiment. At the very least, if one wanted to use Lidz et al.'s findings to cast doubt on children's knowledge of the constraint on anaphoric *one*, one would also need to know what children would do in a comparable control condition (e.g., a condition in which two readings are available, one reading is associated with one object in the visual display and one reading is associated with both objects in the visual display). The choice of such control condition might turn out to be quite difficult, given how little we know about ambiguity resolution in 18-month-old children. For these reasons, we will conclude here that the experiment conducted by Lidz et al. (2003) cannot be used to investigate one of the issues that they wanted to investigate, namely children's knowledge of the constraint on anaphoric *one*. Lidz and Waxman (2004; p. 158) write: "Our original argument, following Baker, 1978, went like this. The acquirendum is the knowledge that *one* is anaphoric only to syntactic constituents larger than N° (i.e., the phrasal categories N' or NP)." Our claim is that when it comes to that acquirendum, the experimental findings are uninformative.

Given that Lidz et al.'s experiment does not speak to one of the issues that they had hoped to address, a possible approach would be for us to design an experiment that would speak to that issue. Unfortunately, the experimental findings offered by Lidz et al. (2003) would make the results of such an experiment quite difficult to interpret.

Suppose an experiment was constructed for which different behavior is expected depending on whether or not the subject knows the constraint on anaphoric *one*. This could be achieved if infants were presented with two

objects; one object corresponding to the head noun and one corresponding to the N'. Then, suppose that upon being presented with linguistic stimuli containing anaphoric *one*, children displayed a robust preference for the object corresponding to the N' constituent. Ordinarily, such a result could be interpreted as showing that children know the relevant constraint. Unfortunately, the results provided by Lidz et al. (2003) might make this conclusion problematic. In particular, the fact that children display a preference even when a preference is not predicted suggests that some unknown factor is at play.<sup>3</sup> At the moment, we would have no way of excluding the possibility that children's behavior in the experiment we are hypothesizing would be triggered by that unknown factor and not by knowledge of the constraint on anaphoric *one*.

To sum up, Lidz and Waxman (2004)'s use of the experimental evidence documented by Lidz et al. (2003) as an illustration of children's knowledge of anaphoric *one* is unwarranted. That experiment does not bear on the issue of whether children know that *one* cannot target the head noun and, if anything, the experimental results documented by Lidz et al. (2003) point to a confounding factor that would need to be taken into consideration when conducting any experiment on children's knowledge of the constraint on anaphoric *one*. Given the unavailability of experimental evidence, we are forced to consider alternative sources of evidence. One viable alternative is an argument that rests on logical grounds, the argument from the Poverty of the Stimulus.

## 2. Anaphoric One and the Logical Problem of Language Acquisition

As we said above, the experiment conducted by Lidz et al. did not offer evidence regarding children's knowledge of the constraint on anaphoric *one*. Let us now consider whether evidence for this conclusion could come from adult speakers of English. In this section, we will highlight the relevance of anaphoric *one* as case study for the logical problem of language acquisition. We will conclude this section by briefly discussing the role of semantic evidence in language acquisition, and we will illustrate how the acquisition of anaphoric *one* could, in principle, be turned into an empirical problem.

The argument from the Poverty of the Stimulus claims that if adult speakers of English have the state of knowledge represented in (6) (see

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<sup>3</sup> We will consider two hypotheses about children's preference in the concluding part of the paper.

Hornstein and Lightfoot (1981; p.20)), then children must start off from the same hypothesis.

- (6) rules referring to the identity of two elements apply only to major categories, i.e., with one or more bars.

The logical problem of language acquisition follows from the observation that some (incorrect) hypotheses could only be abandoned on the basis of negative evidence (see Chomsky, 1980). For instance, even a sentence that unambiguously points to *N'* as the intended antecedent of anaphoric *one* might not allow the child to recover from the hypothesis that *one* can refer to any element in the noun phrase (see Lasnik and Uriagereka, 2002 for a similar argument in a different domain).

It is important to notice that in the present case the learner cannot even avail himself of the Uniqueness Principle (see Pinker, 1984; Wexler and Culicover, 1980). As Fodor and Crowther (2002) recently showed, the Uniqueness Principle exploits the assumption that there should be at most one form for any intended meaning. Thus, as Fodor and Crowther (2002) argue, the Uniqueness Principle turns out to be useless when there is no alternative form that could stand in competition with the form hypothesized by the child or when the target grammar actually licenses an ambiguity, thereby violating the assumption that there should be exactly one form for any given meaning. The case of anaphoric *one* seems to satisfy both requirements. There is no form that can only be anaphoric to head nouns and that could be used to eliminate the head noun  $N^{\circ}$  from the set of possible options for *one*; moreover, sentences containing *one* can be associated with more than one meaning, depending on whether *one* is anaphoric to the entire noun phrase or to any of the *N*'s available in the relevant noun phrase.

Let us go back to the child's task. The question is how the child avoids any hypothesis that would prevent him from reaching (6). According to one line of research, Universal Grammar prevents the child from entertaining any hypothesis that would make the target generalization unattainable on the basis of positive evidence. Certain hypotheses must be excluded from the child's hypothesis space, in order to ensure that the correct hypothesis can be acquired on the basis of positive evidence. To illustrate, suppose that (6) is not part of the initial state and that the child initially assumes that *one* is anaphoric to the head noun  $N^{\circ}$ . Upon encountering an utterance in which *one* is unambiguously anaphoric to *N'*, the child could simply modify his hypothesis and assume that *one* can be anaphoric to *N'* or to  $N^{\circ}$ . In other words, positive evidence of the kind described above can lead the child to expand the set of



elements that *one* can be anaphoric to, but it cannot lead the child to expunge any member from that set.

On the assumption that negative evidence is not available, children will hear no ungrammatical sentence labeled as such (see Marcus, 1993). For example, children will not hear sentence (1) together with an indication that that sentence is ungrammatical. The absence of explicit information about ungrammatical sentences makes it impossible for the child to learn that anaphoric *one* cannot be anaphoric to a head noun. If (6) is indeed part of the linguistic competence of all native speakers of English, given the lack of negative evidence, it must be the case that (6) is also part of the linguistic competence of any child, prior to experience.

It is important to stress the importance of the argument above for the debate sparked by the publication of Lidz et al. (2003). Once we take into consideration some of the properties of the final state, it is not even necessary to look at the properties of the input. We have known since the work of Brown and Hanlon (1970) that the input does not contain negative evidence. When it comes to the constraint on anaphoric *one*, the input isn't impoverished, the input is non-existent.

The discussion above highlights one important point. When analyzing the primary linguistic data in search of information that would lead children to acquire adult competence, it is important to take into account the particular hypothesis about the adult state that is put forward. In the present case, the acquirendum is a constraint. Utterances that conform to a constraint do not provide evidence for it. To achieve that result, the learner would need to have access to negative evidence, which is unavailable to children. Thus, under current assumptions, the acquisition of anaphoric *one* represents an argument for the logical problem of language acquisition.

We would like to discuss briefly what could turn the acquisition of anaphoric *one* into an empirical rather than a logical problem. In principle, this could be achieved, if one could make use of semantic negative evidence (see Baker (1978) for a discussion of how this could apply to the case of anaphoric *one*), which unlike syntactic negative evidence might turn out to be available. In essence, one could argue that children would learn the constraint on anaphoric *one* on the basis of utterances in which two requirements are satisfied: *one* refers to N' and it can be inferred from the speaker's contribution that *one* cannot refer to the head noun N°. To date, there is no explicit proposal about how this could be achieved, but one possibility is the dialogue below (see also Baker, 1978).

(7) Speaker A: Yesterday, you met a student of syntax. Have you met another one today?

Speaker B: No, I haven't met another one! Today, I met a student of pragmatics.

Let us consider what the learner could infer from hearing the dialogue above. One conclusion is straightforward: *one* can refer to the constituent *student of syntax*. The second conclusion is the following: on the assumption that Speaker B was trying to be charitable, one could infer that Speaker B has no choice but to interpret *one* in Speaker A's utterance as referring to the N' constituent *student of syntax*. In turn, we could infer that it is not possible for Speaker B to interpret *one* in Speaker A's utterance as referring to the head noun N° *student*.

This reasoning abstracts away from other parsing preferences that could enter into play. As we will see in the concluding section of the paper, it is reasonable to assume that in presence of an ambiguity for *one*, listeners draw upon different parsing mechanisms. The influence of these parsing mechanisms can be quite strong. Thus, a listener might refrain from accessing an antecedent for *one* that is contextually irrelevant, even though that antecedent would not lead to a violation of the constraint in (6). For instance, it is not clear whether a speaker would respond 'yes' to a request that included an adjunct rather than a complement (e.g., "*Yesterday, you met a student with long hair. Have you met another one today?*") In sum, although one cannot rule out on principled grounds the possibility that children make use of dialogues like the one above, more research is needed to determine whether that possibility is empirically grounded. In turn, this means that we need to investigate whether children would be capable of using the information described above and whether this kind of information is available to them.

This finally takes us to the corpus analysis performed by Lidz et al. (2003). These authors found only two utterances that pointed unambiguously to N' as the antecedent of anaphoric *one*. Moreover, Lidz et al. (2003) found that utterances that pointed unambiguously to N' as the antecedent of anaphoric *one* were outnumbered by ungrammatical sentences (containing *one*). Unfortunately Lidz et al. (2003) do not provide us with the two examples they found, so we can't tell if those utterances would qualify as the data needed by the mechanism described above. For instance, as Lidz et al. (2003) argue, in a context in which Max has a blue ball, (8) would count as unambiguous evidence that *one* is being intended as referring to the N' *red*

*ball*, but does not necessarily mean that the speaker could not possibly also take *one* to refer to the head noun *ball*.

(8) Chris has a red ball but Max doesn't have one.

It is possible that the speaker could take *one* to refer to the head noun N° *ball* but is not doing so on the present occasion, just like he can presumably take *one* to refer to the N' *ball* but is not doing so on the present occasion.<sup>4</sup> This demonstrates that the utterances in which *one* refers unambiguously to N' may not count as utterances in which *one* refers unambiguously to N' and could not possibly refer to N°. Thus, we can be confident in saying that the data that would provide negative semantic evidence for the constraint on anaphoric *one* occur at most with a frequency that is lower than noise.

### 3. Anaphoric *One* and the Role of Indirect Negative Evidence

An interesting contribution to the debate on anaphoric *one* comes from Regier and Gahl (2004). In their study, Regier and Gahl (2004) present the results of a Bayesian learning procedure designed to mirror Lidz et al.'s findings. The results are interpreted as showing that it is possible to learn that anaphoric *one* refers to the 'upper N', given the kind of sentences available to children. According to Regier and Gahl (2004), the results of the learning procedure cast doubt on the implications of the study by Lidz et al. (2003). More importantly, one might argue, their learning procedure also casts doubt on the argument from the Poverty of the Stimulus as we have presented it above.

The indirect learning procedure envisioned by Regier and Gahl (2004) allows the learner to adjudicate between different hypotheses that are consistent with the data, by taking into account the probability of observing the data under each competing hypothesis (see Tenenbaum and Griffiths, 2001). The hypotheses considered by Regier and Gahl (2004) are listed below.

- (9)
- a. *one* refers to [N' yellow bottle] as specified by a nested structure
  - b. *one* refers to [N' bottle] as specified by a nested structure
  - c. *one* refers to [N° bottle] as specified by a nested structure
  - d. *one* refers to [N° bottle] as specified by a flat structure

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<sup>4</sup> It is possible that the dialogue in (7) is subject to the same consideration, even though the issue is most relevant in the case of (8). This is because the presence of two N's readily shows the listener that he should not take the speaker's choice to use *one* as referring to a particular syntactic object as dictated by the lack of viable alternatives, since at least one alternative is available.

To illustrate, imagine we only have two bottles: a yellow bottle and a blue bottle. Suppose the learner encounters one clear instance of anaphoric *one* used to refer to a yellow bottle. This outcome is consistent with any one of the hypotheses listed above. However, under each hypothesis, the available evidence has a different probability of occurring. In fact, we can state the probability of observing the evidence under each hypothesis.

- (10) a. if *one* refers to [N' yellow bottle] as specified by a nested structure, then the probability of *one* referring to the yellow bottle available in the context is 1
- b. if *one* refers to [N' bottle] as specified by a nested structure, then the probability of *one* referring to the yellow bottle available in the context is 0.5
- c. if *one* refers to [N° bottle] as specified by a nested structure then the probability of *one* referring to the yellow bottle available in the context is 0.5
- d. if *one* refers to [N° bottle] as specified by a flat structure then the probability of *one* referring to the yellow bottle available in the context is 0.5

It is important to observe that one single instance of positive data (knowing that *one* refers to the yellow bottle available in the context) yields a different probability of observing the available evidence if any of the hypotheses in (9b)-(9d) was true, while leaving untouched the probability of observing the evidence if (9a) was true. The consequences of this difference in probability are even more dramatic if the learner can count on several cases of anaphoric *one* being used to refer to the yellow bottle available in the context. Regier and Gahl (2004) observe that even if one assumes that all the relevant hypotheses were equally probable before observing the evidence, after observing five instances of *one* being used as anaphoric to the yellow bottle, an experience that would be the only outcome expected under (9a) but one of the 32 outcomes compatible with (9b) - (9d), the difference in probability could be used to adjust the relative weight of the hypotheses in (9). Eventually, this would justify the selection of (9a) at the expense of all the competing hypotheses.

Having summarized the study by Regier and Gahl (2004), we can turn to the objections to that study offered by Lidz and Waxman (2004). One critique offered by Lidz and Waxman (2004) is that the model proposed by Regier and Gahl (2004) is too powerful:

“In short, the use of indirect negative evidence in the fashion proposed by R&G leads to a grammar in which it is never possible for *one* to refer to the lower of two N’s, contrary to fact. (p.164-165)”

In our view this critique is undue. If children’s preference for the object that corresponds to the upper N’ counts as evidence for knowledge of (6), then Regier and Gahl (2004)’s results bear on the debate. As far as we can see, Regier and Gahl (2004) examined the proposal by Lidz et al. (2003) under its most favorable circumstances.

As Regier and Gahl (2004) acknowledge, more results from computational modeling need to be examined before their possible contribution in modeling language acquisition can be evaluated. In particular, it would be important to discuss whether there are any restrictions in the way the hypothesis space needs to be represented. Specifically, it would be important to determine whether the relevant generalization could be learned on the basis of different data (e.g., post-nominal prepositional phrases) and whether that generalization could be extended to different environments.

For the time being, however, all we can do is consider the particular learning model proposed by Regier and Gahl (2004). Their learning model is designed to mirror the findings offered by Lidz et al. (2003). Thus, just like we dismissed the experimental findings by Lidz et al. (2003) as irrelevant for the acquisition of the constraint on anaphoric *one*, we must dismiss the particular model proposed by Regier and Gahl (2004).

Within the domain we are considering, the first question one needs to ask is whether the correct generalization (which implies that *one* can refer to any N’) could be learned. In our view, the answer is no. The learning model described by Regier and Gahl (2004) cannot learn what children acquire.

One interesting feature of the simulation offered by Regier and Gahl (2004) is that the probabilities of observing the evidence under (9b)- (9d), ‘are identical throughout.’ This is not an accident. The relevant probabilities follow the same path because under any hypothesis, the probability that one stumbled on a yellow bottle is given by the number of yellow bottles divided by the number of bottles. Bottles do not come as labeled. The probability of a yellow bottle turning up is given by how things are in the real world and does not change depending on whether we are interested in bottles as corresponding to N’ objects or N° objects. Thus, the probability of observing the evidence will always be identical for all the hypotheses in (9b) - (9d). This has a crucial consequence for the learning algorithm. No experience will allow the learner

to differentiate between (9b) and (9c). In particular, no experience will allow the learner to reject both (9c) and (9d) and to save both (9a) and (9b), which could be viewed as the most straightforward way of representing knowledge of the fact that both N's are suitable targets for anaphoric *one*.

We would like to point out an additional issue for the approach proposed by Regier and Gahl (2004). According to their model, learning seems to proceed conservatively. The child (presumably) discards any hypothesis that does not account for the data. Furthermore, among the hypotheses that do account for the data, the child privileges the hypothesis that does not require improbable assumptions to 'explain' the evidence. On this view, it would be very surprising if children ended up following hypotheses for which they have no evidence at all. Surprisingly for the model proposed by Regier and Gahl (2004) and for any model that makes a similar use of indirect negative evidence, many studies have shown that such a scenario is very common (see Thornton, 1990 for a well-known illustration of this phenomenon and Meroni, Gualmini and Crain, 2001, for a recent review). In fact, the discovery that children's grammars often differ from the grammar of the local community and still do not exceed the boundaries of Universal Grammar has led to the Continuity Hypothesis, which arguably constitutes the strongest version of the innateness hypothesis (Crain and Thornton, 1998; Crain, 1991; Crain and Pietroski, 2001).

#### **4. Anaphoric *One* and the Distinction between Language Acquisition and Language Use**

The previous sections reviewed the Poverty of the Stimulus argument as it applies to the case of anaphoric *one*. Even though the focus of the present paper is on learnability and on the logical problem of language acquisition, we cannot ignore one feature of the data documented by Lidz et al. (2003). Even if one accepts the validity of the Poverty of the Stimulus argument the way we have presented it above, we are still missing an explanation for children's behavior. As we have repeatedly argued, knowledge of the internal structure of noun phrases and knowledge of the properties of anaphoric *one* are certainly consistent with the data. However, knowledge of the internal structure of Noun Phrases and knowledge of the constraint on anaphoric *one* alone do not explain the data.

Ever since the beginning of generative grammar, a crucial distinction was drawn between how linguistic competence is acquired and how it is put to use. Lidz et al. (2003) were concerned with the acquisition of linguistic

competence. However, it is also important to spell out their assumptions about how competence is put to use. In particular, a child who knows the internal structure of Noun Phrases and the constraint on the interpretation of anaphoric *one* will occasionally face an ambiguity. This is exactly what happened in the Lidz et al.'s experiment. Upon hearing '*Look! A yellow bottle. Now look. Do you see another one?*', a child who has all the relevant knowledge will have to determine whether *one* refers to the upper or lower N' in the structure in (3). The findings documented by Lidz et al. (2003) suggest that children prefer the upper N'. The question is why.

A plausible hypothesis suggested by Tomasello (2004) and Akhtar et al. (2004) is that 18-month-old children simply look at the familiar object. Lidz and Waxman (2004) point to a previous study with 21-month-old children by Waxman and Markow (1998) which casts doubt on that hypothesis. We are still in need of an explanation.

We would like to propose two explanations, both of which can be independently motivated. We will leave to further research the task of putting these hypotheses to the test. As far as we are concerned, we simply want to demonstrate that it is possible to explain the data under the scenario envisioned by the Poverty of the Stimulus argument.

Our first proposal draws upon recent studies in adult sentence processing. This particular solution originates from the observation that the child has to choose between two constituents such that one contains the other. Descriptively, we could simply say that when facing an ambiguity of that kind, children favor the largest constituent. The question is then whether there is any way to tie this hypothesis with adults' behavior in similar situations. A relevant study with adults was conducted by Frazier and Clifton (2005). Among other structures, these authors looked at VP-ellipsis and sluicing. The results suggest that when a choice is possible between two constituents such that one contains the other, adults do indeed show a preference for the largest constituent.

A second possible explanation of the experimental findings is semantic/pragmatic in nature. We need to explain why the child interprets the instruction "*Do you see another one?*" as "*Do you see another yellow bottle?*" rather than "*Do you see another bottle?*" One possibility is that the child selects the interpretation that can be answered affirmatively and felicitously (see Grice, 1975). The child does not see another bottle; the child sees two other bottles! We do not know if the 18-month-old infants who participated in the study said 'yes, I do see another yellow bottle' to the experimenter, but as

far as we can tell that might be all they fell short of. At first glance, the present solution seems to be at odds with children's reluctance to compute scalar implicatures documented in previous studies (see Guasti, Chierchia, Crain, Foppolo, Gualmini and Meroni, 2005, for a recent review). However, it must be kept in mind that the implicature associated with number words, which would seem most relevant for the present case, is by far the easiest for children to compute (see Papafragou and Musolino, 2003).

Either one of the proposals sketched above accounts for the data documented by Lidz et al. (2003). Under either scenario, the differences between children and adults turn out to be quite minimal. The data can be explained under the assumption that children and adults employ the same universal processing mechanisms (see Crain and Thornton, 1998; Meroni and Crain, 2003a;b).

## 5. Conclusion

The present paper scrutinized the phenomenon of anaphoric *one* as a case study for language acquisition. We began with a study by Lidz et al. (2003; p. B72) which argued that:

“In the domain of anaphoric reference, learnability considerations lead to the conclusion that learners never consider the possibility that an element could be anaphoric to N°. (...). This logical conclusion is now supported by corpus analysis and by experimentation with infants.”

We argued that, under current assumptions, the experimental findings documented by Lidz et al. (2003) do not support that conclusion. Thus, we pursued a different approach, and we argued for children's innate knowledge of the constraint on anaphoric *one* on conceptual grounds. The argument from the Poverty of the Stimulus may be old, but it is still valid.

There is no doubt that experimental investigations are important. For instance, a study that investigated adults' judgments of the sentences we started with would provide a useful contribution to the debate. When it comes to child language, empirical investigations can tell us whether children go through 'stages of development.' In turn, these can be used to evaluate different proposals about the way children select the correct grammar out of the possibilities given by Universal Grammar (see Yang, 2003). Similarly, when possible, it might be reassuring to observe that children obey a given constraint (see Sugisaki, 2005, for a recent successful attempt that deals with



another constraint on anaphoric *one*). Nevertheless, this should not lead us to undermine the value of logical arguments or to seek for supporting evidence with experiments that do not speak to the issue under consideration.

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