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Backward Versus Forward Anaphora: Reconstruction in Child Grammar

Maria Teresa Guasti
University of Siena

Gennaro Chierchia
University of Milano

Various cases of backward and forward anaphora are studied in a number of seemingly unrelated constructions and argued to be a manifestation of a unitary principle, namely Principle C of the Binding Theory (Chomsky, 1981; 1986). We point out an unexpected restriction on (forward) anaphora that is argued to be a case in which Principle C operates at the "reconstructed" level. Italian-speaking children manifest an early mastery of these constructions (age 3;10). Contrary to what several proposals may lead one to expect, the ability to correctly judge instances of forward anaphora and the ability to correctly judge instances of backward anaphora manifest themselves simultaneously. These results on one hand provide evidence in favor of a biologically determined mechanism subsuming both standard Principle C effects and cases of "reconstruction." On the other hand, they support the view that certain cases of movement are, as they were, automatically "undone" when anaphoric dependencies are computed, as predicted by recent theories of movement as copying.

1. INTRODUCTION

A great deal of work in developmental psycholinguistics has been devoted to the study of anaphoric relations, that is, relations holding between a pronominal form and an antecedent in which the interpretation of the former depends on the interpretation of the latter (e.g., Chien and Wexler (1990), Crain and McKee (1986), Jakubowicz (1984), Lust, Eisele, and Mazuka (1992), among others). Less attention has been devoted to the emergence of "reconstruction" effects involving pronouns. In terms as weakly theory-bound as possible, one might say that reconstruction effects occur when a certain phrase XP has been displaced from its canonical base position A but still retains certain properties typically associated

Requests for reprints should be sent to Maria Teresa Guasti, Università di Siena, Scienze della Comunicazione, via del Giglio 14, I-53100 Siena, Italy.

with A, rather than with XP's surface position. If, for example, the displaced constituent XP contains an anaphora, such anaphora can be interpreted as if the XP were reconstructed in its base position, as in (1):

(1) A picture of himself Mary says that John would never put on sale __.

More generally, the existence of reconstruction effects implies that in some cases the representation relevant to the principles of the Binding Theory (BT; see Chomsky (1981; 1986); see for an alternative approach Reinhart and Reuland (1993)) has to be one in which the effects of movement are undone. In this article, we study the emergence of reconstruction effects in child grammar. We focus in particular on effects involving Principle C of BT.

Why study reconstruction? Consider the pair of sentences in (2):

(2) a. He saw a snake near John.
b. Near John, he saw a snake.

In the adult grammar, these sentences are both ungrammatical on the reading in which *he* and *John* are taken to corefer (barring special contexts). Here there is a general issue of how constraints of this sort (which ban certain readings) are mastered by the child, an issue debated in much current literature. Pairs such as those in (2) add a further dimension to such an issue. The question is whether knowledge of the ungrammaticality of (2a), a case of ungrammatical backward anaphora, and knowledge of (2b), a case of ungrammatical forward anaphora, manifest themselves simultaneously in the child. Generally speaking, forward and backward anaphora work differently both structurally and in terms of processing (given that we tend to process things on line). It has also been claimed that the child has difficulty with backward anaphoric links (Tavakolian (1978)). On these grounds, there might be no reason to expect simultaneous emergence of adult-like behavior for (2a) and (2b). Since at least Reinhart (1983a), many have argued that the ungrammaticality of (2a) and (2b), on the anaphoric interpretation, is due to the same principle. For example, in terms of BT, (2a) is ruled out by Principle C. Under the independently plausible assumption that (2b) is derived from (2a) by dislocating the adjunct *near John* to the left, one can claim that in (2b) one first reconstructs back the dislocated adjunct, and then Principle C applies in the usual manner. However, the existence of a unique principle governing cases of backward and forward anaphora is not per se very telling for acquisition, for such a principle might apply in different ways in (2a) versus (2b), and this might yield a temporally differentiated emergence of the proper understanding of (2a) versus (2b). In contrast to the hypothesis just sketched, recent approaches to reconstruction (e.g., those inspired by Chomsky (1993) and Fox (1999), among others) make a different, arguably sharper prediction. According to such approaches, the structures of (2a) and (2b) are virtually identical and, hence, the ruling out of the two

cases *has* to be uniform. If Universal Grammar drives acquisition, this seems to predict that as soon as children get (2a) right, they must also get (2b) right. This is the opposite of what one would expect just by considering how forward and backward anaphora work in general. Thus, looking at reconstruction effects in child grammar might help us choose among these different hypotheses.

Sentences such as those in (2) have been studied in the acquisition literature, as we see from our review of some of the relevant works (in section 4). However, these studies are not directly aimed at testing whether there is evidence of an identical and simultaneous treatment of ungrammatical forward and ungrammatical backward anaphora. Some studies have addressed the issue of whether children's comprehension of sentences like (2a) and (2b) is guided by a unique principle. However, on one hand, conflicting results were obtained, probably because of the experimental material employed (see Carden (1986), Hsu, Cairns, Eisenberg, and Schlisselberg (1989), Ingram and Snow (1981), Lust, Loveland, and Kornet (1980)). On the other hand, it was observed that, beyond Principle C, other factors appear to influence children's performance.

To overcome these difficulties, we designed a number of experiments (conducted with Italian-speaking children). Anticipating our findings, with quantified noun phrases (NPs) such as those in (3), we found a highly uniform behavior in children's speech with respect to Principle C. Consider the sentences in (3).

(3) a. He put a gun in every pirate's barrel.
    b. In every pirate's barrel, he put a gun.

These sentences are ungrammatical on the reading in which *he* is anaphorically dependent on (i.e., bound by) *every pirate.* We found that as soon as children reject (3a), they also reject (3b) on the relevant reading.[1] In other words, Italian-speaking children show an adult-like behavior with respect to an ostensibly complex array of reconstruction effects.

These results, on one hand, constitute further evidence that the mechanisms responsible for the behavior of pronouns become operative extremely early in the child's development; on the other hand, they provide experimental support for the view that reconstruction comes for free. Moreover, they set the stage for further interesting investigation of BT. In particular, in studying Principle B of BT, an asymmetry has been noticed in child language between (4a) and (4b):

(4) a. John likes him.
    b. Every boy likes him.

At an age when children get (4b) right with respect to Principle B, they are found to make mistakes in letting *him* be construed as anaphoric to *John* in (4a). Contrast (4) with the pair:

[1]As we see, we have not actually tested (3a) but have tested sentences structurally equivalent to it.

(5) a. Near John, he saw a snake. (= 2b)
b. In every pirate's barrel, he put a gun. (= 3b)

From Lust et al. (1980), it appears that the child makes some mistakes with (5a), at least in one of the testing conditions (see also Carden (1986)). In contrast with this, the percentage of mistakes we found with (5b) is so low that it can plausibly be attributed to noise. If these results are further confirmed, we would find in the domain of Principle C something substantially parallel to what one observes with Principle B in child grammar (i.e., essentially, mistakes with coreference, but not with binding—see the following for discussion). At present this remains a conjecture in need of further testing. However, it goes to show the fruitfulness of looking at reconstruction in child grammar.[2]

This article is organized as follows. In section 2, we lay out more precisely our assumptions concerning BT and reconstruction. In section 3, we see how exactly our approach to reconstruction, which draws on much recent work on the topic, comes to predict that the child should acquire the constraints on (3) simultaneously. In section 4, we briefly discuss previous studies on the acquisition of Principle C to put our study in perspective. In section 5, we report on three experiments that address such predictions, and in the final section we discuss our results.

2. A CASE OF RECONSTRUCTION

We start by reviewing how Principle C of BT works. We then consider a set of facts that, we argue, can only be explained by appealing to reconstruction. Having done that, we present our assumptions about reconstruction and turn, finally, to discussing what consequences follow for acquisition.

2.1. Principle C

The status of BT is controversial. For the sake of explicitness, we now outline our take on it. We think, however, that our results will be relevant also for approaches that interpret BT differently.

One well-known empirical generalization is that a pronoun cannot c-command its antecedent.[3] Consider the following sentences:

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[2]Also important is the crosslinguistic perspective that our study contributes. If a given principle is claimed to be innate, it should emerge roughly at the same time regardless of the language. In this regard, our study is in the same spirit as McKee (1992), which investigates the emergence of Principle A and B in Italian.

[3]Following Reinhart (1983a), we assume that a node A c-commands a node B if A and B do not dominate each other, and the first branching node dominating A also dominates B.

(6) a. He loves Lee's father.
b. He thinks that Kim hates Lee's father.
c. He is happy when Kim sings.

In all of these cases, the pronoun *he* cannot have any other NP in the sentence as antecedent. Thus, for example, (6a) cannot mean "Lee loves his own father." The facts in (6) are often referred to as cases of *non-coreference* or *disjoint reference,* for they seem to be about what *he* and referential NPs such as *Lee* refer to. Now something in a way related to (6) can be argued to be going on in (7):

(7) a. He hates everyone's father.
b. He thinks that a colleague hates Lee's father.
c. He is happy when a colleague sings.

Here too the pronoun *he* cannot be anaphoric to the embedded NPs.[4] Because such NPs do not, in general, refer to individuals, talk of non-coreference in cases such as (7) seems inappropriate. For historical reasons, the facts in (7) are often referred to as cases of "strong crossover" (see Haegeman (1994), chapter 7). Traditionally, Principle C of BT is supposed to take care of both non-coreference facts (see (6)) and strong crossover facts (e.g., (7)). Such a principle states that an R(eferential)-expression (that is any NP that is not a pronominal, like *Lee, a colleague, everyone,* etc.) must be free, that is, non-coindexed with a c-commanding pronoun. Let us see how this works, starting with strong crossover cases. Let us assume that quantificational NPs must be assigned scope to be interpreted and that this takes place by raising them covertly and adjoining them to some suitable site (a process known in the literature as Quantifier Raising (QR)). Such a process is illustrated in (8):

(8) a. John likes everyone.
b. Everyone$_i$ [John likes t_i].

Structure (8b) is the Logical Form (LF) of (8a). The trace t_i is construed as a variable bound by the moved NP *everyone.* Principle C of BT prevents sentences like (7a) from being interpreted as shown here:

(9) a. He$_i$ hates everyone$_i$'s father.
b. Everyone$_i$ [he$_i$ hates t_i's father].

Under the indexing in (9a), the sentence in (7a) would wind up being interpreted as in (9b), that is, informally, as saying that everyone hates his own father.

[4]For the purpose of this article, we adopt an informal characterization of the notion of "being anaphorically related to." We say that a pronoun *A* is anaphoric to an expression *B* iff *A* derives its interpretation from *B.*

Principle C rules out the representations in (9) and thus, correctly, blocks such an interpretation of (7a).[5] In different, but equivalent, terms, *everyone* and *he* in (7a) are forced to carry distinct indexes, which, under standard assumptions about QR and its interpretation, prevents *he* from being construed as anaphoric to (i.e., in the case at hand, as semantically bound by) *everyone.*

What happens with non-coreference? Assume also that NPs like *John* can be assigned scope (an assumption that seems to be necessary on several grounds—see, e.g., Heim and Kratzer (1997) for a review of some of the key arguments). Then Principle C rules out (10b), the LF representation for (6a) repeated here as (10a):

(10) a. He_i hates Lee_i's father.
b. Lee_i [He_i hates t_i's father].

Consequently, *he* cannot be semantically bound by *Lee.* The only grammatical structure for sentences like (6a) will have to have the following form:

(11) a. He_j hates Lee_i's father.
b. Lee_i [He_j hates t_i's father].

Here *he* remains unbound. However, an issue arises in this connection. Because we know that semantically unbound pronouns can pick up their value from the context, what is to prevent he_j in (11) from picking Lee as its referent? Nothing at all, it would seem. However, *he* and *Lee* would wind up as being coreferential after all, Principle C notwithstanding.

One possible response is to try to set up a formal procedure whereby if in a given structure a pronoun *A* and a referential NP *B* do not carry the same index, then *A* and *B* never have the same reference. However, it turns out to be quite hard to set up such a procedure (while sticking to the standard interpretation of variables via assignment functions; see Chien and Wexler (1990), and Avrutin (1994) for proposals about such a procedure). Moreover, on independent empirical grounds, it seems undesirable to have such a procedure. It has been noted that in many contexts non-coreference is suspended for sentences like (6a). A wide range of such contexts has been pointed out in Evans's (1980) work. A typical case in point is the following:

(12) It is not true that NOBODY hates Lee's father.
He [pointing at Lee's father] does hate Lee's father.

Contexts such as these are arguably special, but also quite natural and systematic. It should be noted that contexts of this sort can never be set up for quantified NPs

[5]In Chomsky's (1981) approach, syntactic variables are assimilated to R-expressions for BT purposes.

such as those in (7). There is just no way of playing with the context that can lead to an interpretation of, for example, (7a), in which *he* is anaphoric to *everyone.*

The debate on how this set of facts should be handled is still wide open.[6] Without trying in any way to settle it, to get going with our experiments, we assume the standard definition of Principle C. We maintain that such a principle, along with Principles A and B, governs syntactic binding, which in turn is interpreted as semantic binding.[7] Furthermore, on top of the standard binding theoretic principles, we assume an interpretive principle inspired by Reinhart's work (see Grodzinsky and Reinhart (1993), Reinhart (1983a; 1983b)), which can be loosely stated as follows:

(13) Rule I*
If a pronoun is not (semantically) bound by an NP A, it is generally interpreted as non-coreferential with A (unless it appears in an Evans-style (1980) context).

*Rule I** governs coreference (or possibly a more general notion that subsumes it) and sets up a default, which is systematically overridden in Evans-style (1980) situations. Rule I* can be made much more precise, though to our knowledge, difficulties remain in making it fully explicit (see, e.g., Heim (1992) for relevant discussion). As the name makes clear, Rule I* is directly inspired by Reinhart's Rule I (see, e.g., Grodzinsky and Reinhart (1993)) and by previous work in a similar vein (e.g., Dowty (1980)). Rule I states that "NP A cannot corefer with NP B if replacing A with C, C a variable A-bound by B, yields an indistinguishable interpretation" (Grodzinsky and Reinhart (1993, 79)). This rule has the effect that a coreference reading is possible only if the same reading cannot be obtained with the mechanism of bound anaphora. The main reason why we do not adopt Rule I is that we do not wish to make any claim about whether cases of strong crossover can be subsumed under a suitably formulated version of Rule I (which is one way of interpreting Reinhart's proposal; see Reinhart and Reuland (1993)). It may turn out that a version of Rule I can subsume all of the effects of Principle C in an explicit and noncircular manner; however, we prefer to stay neutral on this issue. Moreover, we do not want to get into the technical aspects of the definition of *indistinguishable interpretation.* It is worth emphasizing that situations analogous to the one we found with Principle C arise also with Principle B (see (4)).

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[6]Discussion relevant to the formal semantics associated with BT can be found in many places (e.g., Bach and Partee (1980), Dowty (1980), Heim (1992), Reinhart and Reuland (1993)). On the acquisition side, see Chien and Wexler (1990) and Avrutin (1994).

[7]By *semantic binding* we mean the semantic link that in standard quantification theory holds between a quantifier Qx and occurrences of x in a formula of the form $Qx[\beta]$. A standard definition of semantic binding is in terms of assignment functions. One says that x is semantically bound in a formula α iff the value of α (relative to a model M and an assignment function g) does not depend on what the assignment function g assigns to x (see Chierchia and McConnell-Ginet (1990, chapter 3) or Heim and Kratzer (1997, chapters 9 and 10) for a discussion of the relevant notions).

Consider the following:

(14) a. John likes him.
b. Everyone likes him.

Here, Principle B prevents *everyone* from binding *him* in (14b), but under a fairly standard assumption, it does not block coreference in (14a). In fact, cases like (14a) do admit coreferential interpretations in Evans-like (1980) contexts. For example, consider the following sentence:

(15) [Speaking of John]. Look fathead. If EVERYONE likes him, then certainly John likes him.

Rule I* is thus meant to apply to all cases of coreference (whether in Principle B or Principle C contexts). Separating BT effects from coreference seems to us especially important in looking at acquisition facts. As it is known from the literature, when children master the adult interpretation of (14b), they keep making mistakes in (14a). It is as if they treat (14a) like adults treat Evans's (1980) contexts—by suspending Rule I*'s default (or rather, in the case of children, by not having properly activated Rule I*). In fact, one of the interesting byproducts of our study, already anticipated in the Introduction, is that something similar to what happens with (14) in child grammar seems to happen with Principle C in reconstruction environments.

To sum up, we have reviewed our main background assumptions on BT. Essentially, we stick to the "classical" version of BT, whose principles, we maintain, govern *syntactic binding,* a formal relation between nodes in the structure of clauses. Of course, syntactic binding has semantic effects (i.e., it is interpreted as semantic binding in the sense of the standard Tarski-style semantics of variables; see Chierchia and McConnell-Ginet (1990, chap. 3)). Non-coreference (which may concern either Principle B or Principle C configurations) is governed by a separate interpretive device, Rule I*. We use this categorization largely as a descriptive one, but one that we think has a clear rationale and that enables us to study some nontrivial features of child grammar. There are many other ways to understand the classical BT and even more ways in which it can be developed. However, we think that our results are not an artifact of our interpretation of BT, and we leave it to the reader to check whether, as we think, they have consequences for other views as well.

2.2. Reconstruction

We present a set of facts and argue that they involve reconstruction. Consider the pair of sentences in (16) (see Chierchia (1995) and references cited there):

(16) a. Someone gets drunk at every teenager's birthday party.
b. At every teenager's birthday party, someone gets drunk.

Both sentences can mean that *for every teenager x, there is someone that gets drunk at x's birthday party.* This means that the universally quantified NP *every teenager,* though embedded in a prepositional phrase (PP), can have scope over the quantified subject in both (16a) and (16b). The key point here is that the PP in (16), whether dislocated or not, is not a scope island. So, for example, (16b) can be assigned an LF such as the following:

(17) Every teenager$_i$ [[$_{PP}$ at t_i's birthday party] [someone gets drunk]].

Now consider sentence (18a). It clearly lacks the reading represented in (18b).

(18) a. At every teenager's birthday party [he gets drunk].
b. Every teenager$_i$ [at t_i's birthday party] [he$_i$ gets drunk].

Sentence (18a) cannot mean *for every teenager x, x gets drunk at x's birthday party.* The question is why. Why cannot *every teenager* bind *he* in (18a)? Suppose there is no formal prohibition against coindexing *every teenager* and *he* in (18). Then because, as we just saw, the relevant PP is not a scope island, we would expect binding to be possible. But it is not. So there must be something that blocks coindexing in (18a).

What is that something? The puzzle has a simple solution under the assumption that the structure relevant for the interpretation of (18a) is not (18b). To establish which is the relevant representation, let us go back to (16a) and consider how its interpretation proceeds. We noticed that (16a), like (16b), means roughly the following: *for every teenager x someone gets drunk at x's birthday party.* To obtain this reading, presumably, the quantifier *every teenager* is raised directly from its postverbal position, yielding (19):

(19) Every teenager$_i$ [someone gets drunk at t_i's birthday party].

An LF like (19) would give rise to the right reading. However, notice now that if the subject *someone* happened to be coindexed with an R-expression, the trace t_i of the quantifier *every teenager,* a straightforward Principle C violation would ensue. With this in mind, let us go back to (18a). It is independently plausible to maintain that the PP in (18a) originates in a verb phrase- (VP-) internal position and is then fronted. Accordingly, the source of (18a) is something like (20).

(20) He gets drunk at every teenager's birthday party.

Assume now that the interpretation must be done off the base structure. Or, equivalently, assume that before interpreting (18a), the PP must be "reconstructed" in its base position, in a way that we make precise shortly. After scoping, we then obtain the representation in (21).

(21) *[Every teenager]$_i$ [He$_i$ gets drunk at t$_i$'s birthday party].

Then, the impossible reading of (18a) becomes a straightforward Principle C effect.

Chomsky (1993) proposed (for related cases) an interpretation of traces that enables us to derive the Principle C effects in sentences like (18a) without an actual rule of reconstruction. He suggested going back to the idea that movement is actually copying. On such a view, the structure of (18a) would actually be (22), in which the fronted PP leaves a copy in the canonical base position. The PP in boldface is the trace.

(22) [$_{PP}$ At every teenager$_i$'s birthday party] [he$_i$ gets drunk [$_{PP}$ **at every teenager$_i$'s birthday party**]].

Assuming this, we need to scope the quantifier over the whole sentence. However this is done (several implementations are possible), it is clear that we are stuck with a Principle C violation. In (22), the pronoun *he* c-commands its intended antecedent.

The structure of the argument ought to be quite obvious. The constraint on the interpretation of (18a) is unexpected. One can of course posit a construction-specific condition blocking coindexing (and hence binding) in (18a). However, under the hypothesis that movement is copying and, hence, that the dislocated PP structurally has a copy in its base position, the restriction in (18a) becomes something one would expect. In other words, Principle C plus the copy theory of traces, given independently reasonable assumptions on quantifier scope, predict that (18b) is out.

The generality of the paradigm in (18) and (16) can also be seen from the following examples in which the quantifier is embedded in a direct object rather than a PP.

(23) a. We celebrate everyone$_i$'s birthday the way he$_i$ likes best.
b. Everyone$_i$'s birthday, we celebrate the way he$_i$ likes best.
c. *Everyone$_i$'s birthday, he$_i$ celebrates with friends.

In (23a) we see that the quantifier *everyone* embedded within the object can bind the pronoun *he* contained in an adjunct. This remains possible also when the object is dislocated to the left, as in (23b). So it must be possible to scope the quantifier out of the object NP to a position in which the scoped quantifier is able to bind a pronoun. Yet, (23c) on the reading indicated is impossible. Again the question is why, given that the quantifier is not in a scope island. The only principled analysis that comes to mind appears to be along the lines sketched earlier. The object is dislocated, leaving behind a copy that, on the intended interpretation, gives rise to a Principle C effect:

(24) Everyone$_i$'s birthday [he$_i$ celebrates **everyone$_i$'s birthday** with friends].

The data in (18a) and (23c) are quite robust. What is common to them is that a quantifier included in a displaced phrase can have scope over the whole sentence but cannot bind a pronoun in subject position. We argued that this can be explained by appealing to the idea that movement is copying in which the copy left behind is not pronounced.

3. PREDICTIONS FOR ACQUISITION

The key empirical generalization we focused on in the previous section can be summarized as follows:

(25) A quantified element in a dislocated constituent A can have scope over but cannot bind a subject c-commanding A's trace.

We have argued that this follows from Principle C. Consider an exemplification of the relevant paradigm again.

(26) a. *He$_i$ celebrates everyone$_i$'s birthday with friends.
b. *Everyone$_i$'s birthday, he$_i$ celebrates with friends.
c. [Everyone$_i$'s birthday] [he$_i$ celebrates with friends **everyone$_i$'s birthday**].

Under the copy theory of traces, the structure of (26b) is (26c), which contains (26a) as a proper subpart. Therefore, there is no way that Principle C can apply to one of the two sentences without also applying to the other.

What follows from this for acquisition? First there is a general point, common to many grammatical constraints studied in recent years. Clearly, we are dealing here with a seemingly "complex" generalization (viz., (25)). The data that substantiate it are fairly "hidden" and require an account that appeals to an intricate interaction of separate modules (movement, scoping, and the BT). So the familiar "poverty of stimulus" argument applies. It is implausible to maintain that generalization (25) could be acquired by some simple abstraction or hypothesis-testing procedure from evidence available to the child. We must assume that the principles responsible for (25) are available to the child as part of his or her acquisition device. This means that as soon as the child understands the relevant lexical entries, he or she should make no mistakes with sentences like (23c) (or (18a)). Techniques to experimentally test such claims have been devised, and we can apply them to the case at hand.

Besides this general point, there is a second set of consequences that descend from the proposed analysis of the paradigm in (26). Because the principle respon-

sible for the relevant generalization also governs strong crossover and, in part, non-coreference (in cases when a pronoun precedes and commands its antecedent), there should be no time lag in the mastery of the relevant constructions. In other words, as soon as the child correctly interprets sentences like (26a), he or she should also correctly interpret sentence (26b) (and vice versa) because the relevant structure for computing the relevant readings is the same.

As we discussed in the Introduction, other a priori plausible hypotheses emerge from the literature that go in the opposite direction. For one thing, backward and forward anaphoric dependencies have rather different properties (e.g., they must be affected differently by processing factors). Second, the idea that (26a) and (26b) are governed by the same principle might be wrong. Third, even on approaches in which sentences like (26a) and (26b) are governed by the same principle, the way in which such a principle applies might be different in the forward or backward cases (e.g., an actual process of reconstruction has to take place or because the directionality of the relation between the antecedent and the pronoun may play a role). On any of these assumptions, there would be no reason to expect that mastery of the grammar of the two structures should develop uniformly in time.

Summarizing, our predictions for acquisition are the following:

(i) Compliance with generalization (25) should manifest itself early on in child grammar.
(ii) The behavior of forward and backward anaphora in child grammar should be uniform (in the structures under consideration); that is, there is no distinction between backward and forward anaphora (because at the relevant level we have a unique structure for computing the anaphoric relation).

Note that if our expectations turn out to be experimentally supported, it would not just constitute evidence in favor of the approach sketched earlier. If the child shows an adultlike behavior with respect to the paradigm in (26) as soon as the presence of the relevant words enable us to test for it, we will have evidence that reconstruction, regardless of which mechanism is responsible for it, appears early on in the child's grammar, in spite of its complexity. This lends support to the hypothesis that the principles at its basis (as other grammatical principles) are not learned.

4. PREVIOUS STUDIES ON PRINCIPLE C

Various scholars have studied children's knowledge of Principle C. An initial finding based on results from act-out tasks was that English-speaking children tend to avoid the backward anaphoric reading of the pronoun and prefer in most cases an extrasentential character as the referent of *he* in sentences like (27) (e.g., Tavakolian (1978)).

(27) While he was playing with the lion, John was happy.

On this basis, it was concluded that children do not have access to backward anaphora. This was attributed to the fact that initially children base their judgments not on structural relations, such as c-command, but on the linear relation of precedence (see also O'Grady, Suzuki-Wei, and Cho (1986), Solan (1983)). For cases of Principle C violations, this view has as a consequence that children eschew the anaphoric interpretation in sentences like (28) not because of Principle C, but simply because of the linear constraint operating in their grammar.

(28) He was playing with the lion, while John was singing.

The conclusion that children base their judgments on linear precedence was challenged by Crain and McKee (1986) (see also Eisele and Lust (1996), Lust and Clifford (1986), Lust et al. (1980), McDaniel, Cairns, and Hsu (1990)). In particular, using the truth–value judgment, Crain and McKee (1986) proved that children from about 3 years of age reject an anaphoric reading of (28) 88% of the time, whereas they accept this reading in 73% of the cases in (27). In the same vein, Lust et al. (1992), crediting Lust et al. (1980), reported that in an act-out task, English-speaking children give an anaphoric interpretation to sentences such as (27), in which grammar allows it, significantly more often that in sentences like (28), in which the grammar prohibits it. In summary, there is converging evidence from studies using different methods that English-speaking children's interpretation of anaphoric relations is not guided by a linear constraint, but by a structural one, namely Principle C. Children have access to the backward anaphoric reading of the pronoun, but only when Principle C is not violated (see Lust et al. (1992) for a critical survey of these findings).

The claim that precedence is the dominating factor in children's grammar of anaphora has also been challenged by experiments on forward anaphora. As we saw in sentences like (5) earlier, repeated here as (29a), the anaphoric reading is ruled out in the adult grammar (in contrast with what happens in (29b)).

(29) a. Near John, he saw a snake.
b. Near John, his mother saw a snake.

A direct test of this minimal contrast was never carried out to our knowledge. In experiments studying children's comprehension and production of forward anaphora, the test sentences were of the kind in (30) (in which (30a) is a variant of (29a); examples from Lust et al. (1980, 369)):

(30) a. In Cookie Monster's mouth he put a candy.
b. Oscar bumped the wall when he found the penny.

Using an elicited imitation task and an act-out task, Lust et al. (1980) showed that English-speaking children between 3;5 and 7;11 rejected more frequently the ana-

phoric reading in (30a) than in (30b). However, these results were critically examined in Carden (1986) and interpreted differently. In addition, Hsu et al. (1989) presented data obtained in an act-out task suggesting that children have difficulty in handling ungrammatical cases of forward anaphora. Finally, using a question–answer test, Ingram and Snow (1981) found that children accept an anaphoric reading in (30a) as much as they do in (30b)—that is, in 78% of the cases. Carden (1986), and Hsu et al. (1989) came to the conclusion that children perform better on ungrammatical cases of backward anaphora than on ungrammatical cases of forward anaphora, a claim that is disputed by Lust et al. (1992) (see also references cited there). In summary, there is evidence that children conform to Principle C, at least in cases of backward anaphora. More controversial is the issue of whether Principle C is operative in cases of forward anaphora, and consequently the question of whether there is simultaneity in handling ungrammatical forward and backward anaphora.

In all the experiments mentioned, the antecedent of the pronoun is a R-expression. Thornton (1990) tested knowledge of Principle C in strong cross-over contexts, such as (31), in which the possible antecedent of the pronoun is a *wh*-expression. The sentence in (31) cannot mean that I know the person *x* such that *x* said that *x* has the best smile.

(31) *I know who$_i$ he$_i$ said t$_i$ has the best smile.

Children reject this reading 92% of the time, indicating that Principle C must evidently play a role in the child grammar (see Crain and Thornton (1998); see also Roeper, Rooth, Mallis, and Akiyama (1984), McDaniel and McKee (1992)).

Building on these results, we now proceed to test the predictions that the approach to reconstruction adopted here makes.

5. THE EXPERIMENTS

Our aim is to study whether the reconstruction effects identified in section 2 are present in child language and, more specifically, whether the predictions our approach to reconstruction makes are borne out. We have, accordingly, run three experiments (all with monolingual Italian children). The first tests for Principle C in production, the second tests for Principle C in comprehension, and the third is devoted to Principle C in reconstruction contexts. Before reporting on each of them in detail, we illustrate some of their general features. First, the desire to look simultaneously at production and comprehension stems from the obvious consideration that if Principle C is available to the child, it should manifest its effects regardless of the specific modality in which it is employed. Second, and more important, we have argued in section 2 that Principle C governs binding, although some additional factors are at work when non-coreference is concerned (on our approach, non-co-

reference is governed by the interaction of BT principles with Rule I*). Thus, the only way that Principle C effects are not confounded by whatever governs coreference is by looking at quantificational NPs. Consequently, unlike our predecessors, we have carefully avoided strongly referential NPs like proper names and definite descriptions, working instead with indefinites and universals. This has the disadvantage of forcing us to work with somewhat more complex structures (and, hence, we had to make sure that children could handle them) but has the important advantage that whatever effect we get must be due to binding (and its principles) and not to coreference (and its principles). The final distinctive feature of our approach is that we wanted to monitor specifically the simultaneous presence of canonical Principle C effects (which involve cases of backward anaphora) with reconstruction effects (which involve cases of forward anaphora), and the second and third experiment are specifically designed with this goal in mind. With these preliminaries in place, let us now turn to the specifics of each experiment.

5.1. Experiment 1

In the first experiment, we used an elicited imitation task to assess whether children could discriminate between sentences that permit anaphoric readings of pronouns and sentences that preclude them in backward anaphora contexts (for a justification of the experimental task, see Lust et al. (1980); for criticism, see Crain and Thornton (1998)). A further aim of the experiment was to establish whether children in the relevant age range could handle sentences of the complexity required in the second and third experiment. In this experimental task, the child is invited to repeat each sentence that a puppet has said, and the success or errors in the child's repetition are analyzed.

5.1.1. Participants. Twelve Italian-speaking children participated in this study, ranging in age from 4;0 to 5;5, with an average age of 4;7. The children were from various socioeconomical backgrounds, lived in the Milan area (Italy), and attended the municipality preschool in Cernusco Sul Naviglio.

5.1.2. Procedure. The experimental sessions began with a male bear puppet explaining to the child that a friend of his (a female frog) was learning Italian and so her language was not always quite right. This was meant to justify to the child the fact that the frog could produce sentences in some respect nonfelicitous or nonappropriate to the situation. The frog is then invited to listen to some stories and to show her understanding by describing what happened. Although both the frog and the bear puppet were eager to participate, the bear puppet could not be present during the storytelling because of some other engagement. Given that the bear could not stay, he asked the child to pay attention to what the frog would say and report it to him when he got back. This setup was used to justify a repetition request to the child. After the bear had left to do his chores, the experimenter acted

out short stories with props in front of the child and the frog. At the end of each story, the frog was invited to say what she thought had happened; she would use either a sentence like (32a) (which is grammatical on the anaphoric interpretation) or one like (32b) (which is not). At this point, the bear would come back and ask the child to repeat the frog's utterance. In the English translation, the phonological silent pronominal subject of Italian is indicated in parentheses.

(32) a. Mentre ballava, un pagliaccio suonava la chitarra.
While (he) was dancing, a clown was playing the guitar
'While he was dancing, a clown was playing the guitar.'

b. Andava sul cavallo a dondolo, mentre un musicista
(he) was riding a rocking horse, while a musician
suonava la chitarra.
was playing the guitar
'He was riding a rocking horse, while a musician was playing the guitar.'

Because of the way the scenario was arranged, the child could interpret the repetition request as an invitation either to provide a verbatim report of what the frog said or to report what the frog meant. In the first case, regardless of the grammatical status of the frog's sentence, one would not expect any change in the child's repetition (or one would expect an equal number of changes across different targets due to recall difficulties). Alternatively, if the child understood the task as an invitation to report on what the frog meant, he or she would be induced to repeat the sentences filtering them through her or his grammar (and parser). In this case, the conjecture is that if Principle C is in the child's grammar, he or she should not consider sentences such as (32b) appropriate in a situation in which the anaphoric reading was intended. Thus, one would expect the child to modify the sentence in a way that makes it acceptable as a description of the situation presented. By contrast, because sentences of the type in (32a) are appropriate in the given situation, one would anticipate that children should have fewer troubles in repeating them and should change them significantly less than sentences like (32b).

5.1.3. The session and the material. Children were tested in one experimental session, lasting around 15 min. There were three sentences of the type in (32a) and three of the type in (32b). The structure of the stories for both types of stimuli were alike, and all supported an anaphoric reading of the pronoun. In (33) we give an example, directly in English, of the protocol used in this experiment. Italics indicate enactments.

(33) Protocol of a scenario supporting the anaphoric reading of pronouns.

Exp: This is a story about a smurf looking at a TV program. The smurf has bought some flowers and has to plant them. But, (he) does not want to miss his favorite program.

Smurf: (I) have to plant my flowers, but also want to watch TV, because there is my favorite program. Well, (I) will plant the flowers and watch TV. (I) am good at doing several things at the same time.

The smurf plants the flowers and watches TV.

Exp: Let us see whether the frog paid attention. Frog, could you tell us what happened in the story?

Frog would say either (34a) or (34b) (in which (34a) is inappropriate and (34b) is appropriate).

(34) a. Frog: He was watching TV, while a smurf was planting flowers.
b. Frog: While he was watching TV, a smurf was planting flowers.

At this point, the bear came back and asked the child to repeat the frog's statement to him.

5.1.4. Coding. Children's responses were classified as identical or not to the frog's target statement on the basis of the following criterion. A response was classified as identical to the frog's statement if no *structural* change was operated. Therefore, if some irrelevant word was altered or if the order of verbs was switched around, the repetition was still regarded as matching the target. Here are some concrete examples of repetitions that would be considered identical to the respective targets.

(35) Target
a. Mentre suonava il violino un musicista saltava
While (he) was playing the violin, a musician was jumping
sul letto.
on the bed

Repetition
b. Mentre saltava sul letto, un musicista suonava
While (he) was jumping on the bed, a musician was playing
il violino.
the violin

(36) Target
a. Mentre pattinava sullo skateboard, una bambina
While (she) was skating on the skateboard, a girl
teneva l'ombrello.
was holding the umbrella

Repetition
b. Mentre andava sullo skateboard, una bambina
While (she) was going on the skateboard, a girl

teneva l'ombrello.
was holding the umbrella

(37) Target
a. Piantava i fiori, mentre un puffo guardava
(He) was planting the flowers, while a smurf was watching
la televisione.
TV

Repetition
b. Guardava la televisione, mentre un puffo piantava
(He) was watching TV, while a smurf was planting
i fiori.
the flowers

A repetition was classified as not identical to the target if some structural change was performed. Here are some examples:

(38) Target
a. Mentre suonava il violino, un musicista saltava
While (he) was playing the violin, a musician was jumping
sul letto. (=35a)
on the bed

Repetition
b. Mentre suonava il violino, saltava sul
While (he) was playing the violin, (he) was jumping on the
letto.
bed

(39) Target
a. Piantava i fiori, mentre un puffo guardava
(He) was planting the flowers, while a smurf was watching
la televisione.
TV

Repetition
b. Mentre stava piantando i fiori, guardava
While (he) was planting the flowers, (he) was watching
la televisione.
TV
c. Un puffo piantava i fiori, mentre guardava
A smurf was planting the flowers, while (he) was watching
la televisione.
TV

d. Mentre un puffo piantava i fiori, guardava
While a smurf was planting the flowers, (he) was watching
la televisione.
TV

5.1.5. Results. Overall, children changed the ungrammatical sentences 84% of the time, whereas the grammatical ones were changed 54% of the time. The difference is significant, $\chi^2(1, N = 12) = 6.78$, $p < .010$. Thus, children are changing ungrammatical sentences more frequently than the grammatical ones. From this result, we infer that children are repeating the sentences and filtering them through their grammar. If this were not the case, and the children were thinking that they should repeat the sentence literally, no change or an equal rate of changes should have been found. We interpret the results as an indication that children discriminate between the two types of sentences; that is, they do not treat them as equivalent and change the ungrammatical sentences so as to make them grammatical in the given context. The type of change operated by children consists in omitting the subject, as in (39b), or in moving the offending NP to the main clause, as in (39c), or in fronting the entire subordinate clause, as in (39d).

As is clear from the data presented previously, children also change grammatical sentences quite often—in fact, more than half the time (54%). Several nongrammatical factors may have contributed to this high change rate (e.g., limitation of memory, idiosyncratic preferences, focus lapses on the task, etc.). However, the important point that remains is that children distinguish cases of ungrammatical anaphora from cases of grammatical anaphora.

These results provide preliminary evidence that children are sensitive to differences between sentences violating Principle C and sentences not violating it. Furthermore, they also show that by 4 years of age children master *while*-clauses with indefinites. However, we cannot conclude on the basis of this task that Principle C is solely responsible for the child's behavior, for children change grammatical sentences as well. Moreover, this experiment tests children's production. For these reasons, we ran a second experiment using a truth–value judgment task that is better designed to measure the child's adherence to grammatical principles and test directly children's comprehension.

5.2. Experiment 2

The second experiment tests whether children allow the backward anaphoric reading of pronouns where licit and reject it where illicit (because of Principle C violations). In addition, we also test whether the *exophoric reading* (also called the *extrasentential reading*) is available to children. These same children are then tested to see whether they comply with generalization (25) (i.e., whether they have reconstruction).

This experiment is designed along the lines of Crain and McKee's (1986). The main difference is that we use quantified NPs, and more specifically indefinites in *while*-clauses (see Appendix A for a test showing that children are able to interpret indefinites quantificationally). As pointed out earlier, the rationale for this choice is the necessity to make sure that we are monitoring binding and not (non-) coreference, as there is evidence from both adult and child grammar that these phenomena work differently. The properties of indefinites in temporal clauses are of course quite complex and widely debated (see, e.g., Chierchia (1995) for extensive discussion and an overview of the main literature on the topic), and we cannot possibly review it here. The following brief remarks ought to suffice. Consider the paradigm in (40) involving *when*-clauses (from Chierchia (1995); a similar paradigm can be constructed for *while*-clauses):

(40) a. When a teacher likes a textbook, he usually adopts it.
b. When he likes it, a teacher usually adopts a textbook.
c. *He_j usually adopts it, when a $teacher_j$ likes a textbook.
d. John usually adopts it, when a textbook is well written.

In (40a,b) we have a left adjoined *when*-clause, and we see that indefinites (clearly interpreted quantificationally) act as antecedents of pronouns in both directions. In (40c,d), we have postverbal *when*-clauses. On the anaphoric interpretation, (40c) is ungrammatical. Removal of the pronoun from the subject position (as in (40d)) significantly improves things (although some speakers find (40d) less than perfect, everybody gets a sharp improvement with respect to (40c)). Sentence (40d) shows that backward anaphoric dependencies involving indefinites in postverbal *when*-clauses are possible. However, they are not possible if the pronoun is the main clause subject. This paradigm has a straightforward explanation in terms of Principle C (the subject, but not the object, c-commands the postverbal *when*-clause) and justifies using sentences like (40c) and (40d) to test whether Principle C is active in the child's grammar.

A final reason for choosing sentences like (40c) is that in Experiment 3 we check what happens with instances of generalization (25) previously of the following sort:

(41) In every pirate's barrel, with care he put a gun.

We claim that the ungrammaticality of (41) on the intended reading is due to Principle C. Using different nonreferential NPs and different constructions for Principle C testing in forward and backward cases is a further warranty that if we indeed get a correlation between judgments on (40c) and (41), this will not be due to idiosyncratic properties of NP types.

5.2.1. Participants. Twenty-six Italian-speaking children participated in this study, but 6 participants were discarded because they either did not complete the two experimental sessions or did not collaborate. Thus, the study is based on

20 participants, ranging in age from 3;2 to 5;7, with an average age of 4;5. We divided the participants into two groups: The first group includes 14 children ages 3;2 to 4;11, and the second includes 6 children ages 5;0 to 5;7. The children are from various socioeconomical backgrounds, live in the area of Milan (Italy), and attended preschool either in Cernusco S/N (municipality preschool) or in Milano 2 Sud. We also tested 16 undergraduate students living in the same area.

5.2.2. Procedure. We tested children's comprehension of the relevant sentences using the truth–value judgment methodology (see Crain and McKee (1986), Crain and Thornton (1998)). On a typical trial, an experimenter acted out stories with toys and props in front of the child and a snail puppet, Carolina, manipulated by another experimenter. After each story, Carolina said what she thought had happened in the story, and the child was invited to indicate whether Carolina's report was right or wrong. If she was right, the child would feed her something good, such as ice cream or a piece of cake; if she was wrong, the child would give her something she did not like so that next time she would pay more attention. The reward–penalty scheme makes the game more engaging to children. In no case were children told whether their responses were right or wrong. Whenever the child claimed that Carolina was wrong, he or she was solicited to explain why. Each child was tested individually in a quiet room. Before starting the first experimental session, the child was introduced to the snail puppet, Carolina, and was asked to find out what she likes and what she does not like. It was also explained to the child that Carolina likes very much to listen to stories but that sometimes she does not pay close attention. The purpose of this warm-up period was to make the child comfortable with the experimental setting and to explain the game to him or her. During the warm-up period, the child was also pretested; that is, he or she was presented with a couple of short stories and invited to say whether Carolina's report of what happened was right or wrong. One story elicited a positive answer, and the other elicited a negative one. The purpose of this pretest was to make sure that children could answer both *yes* and *no* and had understood the task.

The adults were presented with the same experimental settings, using toys and props and Carolina, but unlike the children, they were tested in a group and asked to write their answers down.

5.2.3. The sessions and the material. The children were tested in two experimental sessions, lasting around 20 min each. During each session, the child was told 5 stories, for a total of 10 stories. After each story, the puppet said the relevant sentence. The puppet's description included ambiguous sentences like (42), nonambiguous ones like (43), and two control sentences.

(42) Mentre ballava, un pagliaccio suonava la chitarra.
While (he) was dancing, a clown was playing the guitar
'While he was dancing, a clown was playing the guitar.'

(43) Andava sul cavallo a dondolo, mentre un musicista
(He) was riding a rocking horse, while a musician
suonava la tromba.
was playing the trumpet
'(He) was riding a rocking horse, while a musician was playing the trumpet.'

Sentence (42) has two readings: one in which the understood subject is anaphorically linked to the NP *a clown* (backward anaphoric reading) and the other in which the NP is linked to some character salient in the extralinguistic context (exophoric reading). We tested this type of sentence for both readings. We used a mixed experimental design. There were four ambiguous sentences for each child. Half of the children were presented with two sentences, a and b, in contexts supporting the anaphoric reading, and with two sentences, c and d, in contexts supporting the exophoric reading. The other half of the children were tested with a and b in contexts supporting the exophoric reading and with c and d in contexts supporting the anaphoric reading. In (44) we give a story for (42), which supports the anaphoric reading, and in (45) we give a story for the same sentence that supports, instead, the exophoric reading. We provide the story in English translation, indicating in parentheses the subject pronouns, which are phonologically silent in Italian.

(44) Protocol for testing the backward anaphoric reading.
Exp: This is a story about a clown who is playing the guitar. (He) is very good at it. Listen.
Clown: (I) like playing guitar, but (I) also like dancing. (I) am very good at doing both. So, (I) will also dance.
The clown is playing guitar and dancing.
Exp: Let us see whether Carolina has paid attention. Carolina, tell us what happened.
Carolina: I know what has happened. While (he) was dancing, a clown was playing the guitar.
Target: Yes.

(45) Protocol for testing the backward exophoric reading.
Exp: This is a story about a clown and a cowboy. This clown is playing the guitar and the cowboy is listening.
Cowboy: (I) like dancing. This music is very good. Let me dance.
The clown is playing guitar and the cowboy is dancing.
Exp: Let us see whether Carolina has paid attention. Carolina, tell us what happened.
Carolina: I know what has happened. While (he) was dancing, a clown was playing the guitar.
Target: Yes.

As can be seen from the protocols, the contexts elicit positive answers. If the relevant readings are accessible to the child, she is expected to answer *yes* both in the case of (44) and (45), at least sometimes.

The other type of stimulus was sentences such as (43). This sentence is grammatical only on the exophoric reading. The anaphoric reading is ruled out by Principle C. We take the null hypothesis (H_0) to be that children do not have Principle C and want to refute it. The null hypothesis implies that, for children, (43) is ambiguous—that is, children may interpret (43) in a way that adults do not. More explicitly

(46) H_0: Children's grammar does not include Principle C.
Expectations: Children assign to (43) both the anaphoric and exophoric reading.

To refute the null hypothesis, we must show that for children (43) is not ambiguous and lacks the anaphoric reading. In Crain and Thornton (1998), it has been widely shown that to obtain accurate responses the experiment must incorporate the condition of plausible dissent, a principle of pragmatic relevance. We briefly elaborate on this.

As is well known, at least since Grice's (1989) seminal work, language use is not governed merely by truth conditions (the domain of semantics) but also by felicity conditions (the domain of pragmatics). For example, it is felicitous to say that John or Mary will come only if we do not know which one is coming. It is not felicitous to utter such a disjunction if it is evident that John is coming (even though, given the standard truth table for *or,* the disjunction would be true in both situations). Similarly, we may wonder whether a statement is true or false if it is clear that it could in principle turn out to be either way. Otherwise, if its outcome is known, it would not make sense to wonder about it. When felicity conditions for utterances are not met, people tend to make "errors" in interpreting them. We see why this is relevant to our experiment. The child's task is to say whether an utterance is true or false. We may expect the child to answer according to her or his grammar only if we make sure that the felicity conditions for the request are satisfied. If this is not so, the child is put in a position where he or she has to violate either the grammar or the pragmatic norms; in such a situation it is not surprising that grammar may end up being violated. In fact, this is so not only for children, but also for adults, as we show in Appendix B. There we report of a test not satisfying the condition of plausible dissent that we have carried out with adults.

We now see how we can take pragmatic felicity into account in designing our experiment. Consider (43) again, repeated here:

(43) Andava sul cavallo a dondolo, mentre un musicista suonava la tromba.
'He went on the rocking horse, while a musician was playing the trumpet.'

For the child with no Principle C, this sentence allows for two interpretations of the null pronoun anaphoric and exophoric interpretation, schematically indicated in (47) (Int = Interpretation):

(47) Int1 *He = a musician anaphoric reading
Int2 He ≠ a musician exophoric reading

Now, it is relevant to use a pronoun only if there is a suitable antecedent in the linguistic or extralinguistic context. Consequently, the child, just like the adult, can wonder who the referent of the subject pronoun in (43) is only if someone other than the musician is actively present in the context. If there is only one potential antecedent around, for instance, a linguistic one, then that must be what the speaker has in mind, regardless of the grammatical status of the anaphoric link. In other words, even if the sentence violates some grammatical constraint like Principle C, in order to make sense of what the speaker says the child may well feel forced to assign an ungrammatical interpretation (in the case at hand, the anaphoric one) to the utterance for lack of alternatives. To avoid this situation, in our stories we made available to the child two possible antecedents for the pronoun, both of which participate actively in the story. Depending on which referent gets chosen, the sentence turns out true or false. In this way the child has a reasonable chance of answering *no.* Incorporating the condition of plausible dissent makes the experimental protocols somewhat more complex than those in (44) to (45), and to this we now turn.

The story for (43) involved some characters and crucial props: a musician, a clown, a rocking horse, a sled, and a trumpet. Because two readings had to be made available to the child, the story consisted of two parts, each relevant to one of the readings (Int1 and Int2 in (47)). The story goes as follows:

(48) Protocol for testing the illicit backward anaphoric reading.
First part corresponding to Int2 in (47):
Exp: This is a story about a musician who is playing the trumpet and a clown who wants to have fun.
Clown: (I) would like to have fun today. Let me see what (I) can do. Oh, there is a rocking horse. I like riding a rocking horse. Let me try.
The clown tries to sit on the rocking horse, but (he) falls down.
Clown: (I) am too big for this rocking horse. (It) is a pity, because (I) like it very much. But, (I) should find something else. There is a sled here. (I) can try the sled.
The clown sits on the sled.

Second part corresponding to Int1 of (47):
Exp: The musician also would like to try the rocking horse.

Musician: (I) would like to try the rocking horse. (I) am smaller than the clown and can surely sit on it.

The musician, while continuing to play the trumpet, goes on the rocking horse. The clown is still sitting on the sled.

Exp: Let us see whether Carolina paid attention. Carolina, tell us what happened in the story.

Carolina: Oh, this is a story about a clown and a musician. I know what happened. He was riding a rocking horse, while a musician was playing his trumpet.

Target: No.

In the first part of the story, the exophoric reading is under consideration: The clown considers the idea of riding the rocking horse while the musician is playing the trumpet, but in the end he does not ride. Hence, on the exophoric interpretation, (43) is false. This part of the story satisfies the condition of plausible dissent. There is a reason for the child to say that the sentence is false because the clown considered going on the rocking horse. The second part of the story makes the anaphoric interpretation available and also salient because it comes last. On this interpretation, the sentence is true but violates a grammatical constraint, Principle C. The characters participating in the story are mentioned in the lead-in in the order in which they have appeared in the staged event (see Appendix C for a defense of the view that it is grammatical knowledge that guides children's responses and not knowledge of extragrammatical factors).

We anticipate that if children have Principle C, they should provide a negative answer most of the time. By contrast, if they do not have Principle C, they should behave at chance level providing an almost equal number of negative and positive answers.

A last caveat must be mentioned concerning (43) (we thank one of the anonymous referees for bringing this point to our attention). As has been often observed, intonational factors may favor a nonbound reading of pronouns. Therefore, for example, in the English version of a sentence like (43), the exophoric reading is favored by two kinds of intonational contours. One consists of pronouncing *a musician* with a contrastive stress. Another is a parallel contour on the pronoun and the indefinite NP. It could happen that in testing for (43), the experimenter might inadvertently use intonation to bias participants toward the intended (exophoric) reading—which, in the case at hand, is the only grammatical one. However, in Italian it turns out to be easy to control for these factors. The first strategy (contrastive stress on *a musician*) can be easily controlled, for in production, contrastive stress, by definition, must clearly depart from the nuclear stress pattern, and that was never done. The second one (parallel contours), which might be harder to monitor in production, is inapplicable in Italian in the case at hand simply because the relevant pronominals are null subjects and, hence, can bear no stress. It thus seems reasonable to conclude that intonational factors cannot have played a significant role in biasing the results in the case at hand.

Four sentences of type (43) were tested for each child, plus two control sentences, exemplified in (49) and (50), which were designed to discard potential alternative explanations of the results in terms of some nonsyntactic strategy.

(49) Mentre era seduta, una signora mangiava una banana.
While (she) was sitting, a lady was eating a banana

(50) Mentre i leoni erano nel recinto, saltavano sulla sedia.
While the lions were in the pen, (they) were jumping on the chair

Sentence (49) was aimed at discarding the possibility that children accept backward anaphoric readings because they just pay attention to the main clause or to the last sentence they heard. Sentence (49) was presented after a story in which a lady was eating a banana, but not while sitting. To be able to reject this sentence, children must pay attention to the *while*-clause. If they only pay attention to the last sentence, that is, the main clause, they should give a positive answer because the lady was eating a banana. This sentence also allows us to dismiss the hypothesis that children attend only to the sequence of noun–verb–noun (N–V–N) and try to match it with the situation. If this were the case, they should respond *yes* to (49). The second control sentence, in (50), is meant to investigate whether children base their answers on the first clause alone, the temporal clause. This sentence was presented after a situation in which the lions, while in the pen, were not jumping on the chair, but eating. To reject this sentence, children have to pay attention to the main clause. Each session included two ambiguous sentences, two nonambiguous sentences, and one control sentence presented in a random order, different for each child.

5.2.4. Results. Overall, children answered correctly to sentences of type (43)—that is, they rejected these sentences as false 80% of the time. Sentences like (42) were presented in two contexts, one supporting the anaphoric and the other the exophoric reading. In both cases, the correct answer was the positive one. Children accepted the anaphoric reading 92% of the time—that is, they said that sentence (42) on the background of the story in (44) was correct in 92% of the cases. The exophoric reading of the same sentence was accepted 92% of the time (against contexts such as those described in (45)). All children responded correctly to the controls 97% of the time. An analysis of the individual data shows that 8 children accepted (43) as a correct description of the story in (48) in just one case out of four—that is, they made one Principle C error. Ten children made no errors; and 2 children systematically violated Principle C—that is, they gave four out of four incorrect answers. One child was 3;2 and the other was 4;0. If these children are removed, the overall rate of rejection of (43) increases to 89% (cor-

rect answer; the other rates of acceptance do not vary). We discuss separately the behavior of the 2 children that appear to systematically violate Principle C. Summing up, children were able to reject sentences such as (43) on the anaphoric reading as young as 3;10 while accepting backward anaphora in sentences such as (42). Following, we give samples of the children's explanations for why the snail was wrong after sentences of the type in (43):

(51) a. Il pagliaccio voleva andare sul cavallo a dondolo,
The clown wanted to go on the rocking horse,
ma non riusciva.
but wasn't able to
b. Perchè il pagliaccio voleva andare ma non c'è stato, poi
Because the clown wanted to go, but couldn't, then,
il musicista c'è stato.
the musician did it
c. Perchè lui non ci stava e allora s'era fatto male ed era andato
Because he could not fit and then hurt himself and went
sulla slitta.
on the sled

Adults answered correctly to sentences of type (43) 94% of the time; they accepted sentences of type (42) 94% of the time on the anaphoric reading and 41% of the time on the exophoric reading. They responded correctly to controls 100% of the time. Although there are no differences between children and adults with respects to answers to unambiguous sentences requiring knowledge of Principle C, there are differences in the responses to ambiguous sentences. Adults' answers to ambiguous sentences in exophoric contexts were at chance level. Figure 1 displays the responses of the two age groups of children—Group I (3;10–4;11), Group II (5;0–5;7)—and adults (we removed from Group I the two children who violated Principle C). There is no significant difference between children belonging to two age groups.

5.2.5. Follow-up on Principle C violations. In a follow-up study, we investigated further the behavior of the two children that systematically violated Principle C (ages 3;2 and 4;0). These children answered correctly to ambiguous sentences (i.e., they always answered *yes*), but answered incorrectly to all nonambiguous sentences (i.e., they always answered *yes* instead of *no*). It is not the case that these children could not answer *no,* because in the warm-up session and with control sentences they were able to. We suspected that these children developed a strategy for answering that obscured their linguistic behavior. In the story for the nonambiguous sentences (protocol (48)), two interpretations are made available—one allowed by grammar (the exophoric reading) and one disallowed (the anaphoric reading). The exophoric reading evokes a negative answer

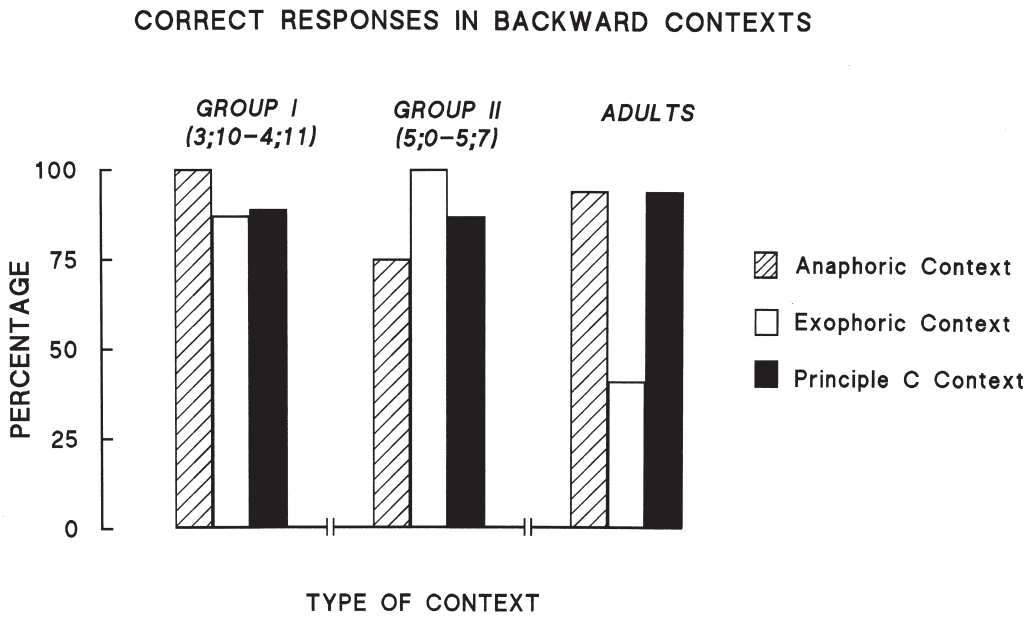

FIGURE 1 Percentage of correct responses by children and adults in backward contexts. The first two columns report the percentage of acceptance of the anaphoric and exophoric readings. The last column reports the percentage of rejection of ungrammatical anaphoric reading (Principle C violations).

(*no*) and is supported by the first part of the story; the anaphoric reading corresponds to a positive answer (*yes*) and is supported by the second part of the story. To answer appropriately, children have to consider the whole story and not just the last event staged in front of them (i.e., the more salient). We suspected that the two children in question responded just on the basis of the last event and deemed as irrelevant what happened before. If a child adopts this strategy, only one interpretation will be available to him or her—namely, the last event. Because such an event evokes a positive answer, children who adopt this strategy will answer *yes.* To investigate this possibility, we reversed the order of the events so that the event corresponding to the interpretation allowed by the grammar comes last (and still evokes a negative answer), whereas the event not allowed by grammar comes first (and still evokes a positive answer). If children base their answer on the last event, they will now tend to say *no.* An example of this modified protocol is given in (52).

(52) Modified protocol for testing the illicit backward anaphoric reading.
First part corresponding to the anaphoric reading (He = a musician).
Exp: This is a story about a musician who is playing a trumpet and a clown who wants to have fun.
Musician: (I) would like to try the rocking horse. (I) enjoy riding it.
The musician, while continuing to play the trumpet, rides the rocking horse.

Second part corresponding to the exophoric reading (He ≠ a musician).

Clown: (I) would like to have fun today. Let me see what (I) can do. Oh, there is a rocking horse, but there is someone on it. Let me ask him whether (I) can have a turn.

The clown asks the musician to have a turn on the rocking horse. The musician gets off while still playing the trumpet. The clown tries to climb on it, but falls.

Clown: (I) am too big for this rocking horse. (It) is a pity, because (I) like it very much. But, (I) should find something else. There is a sled here. (I) can try the sled.

The clown sits on the sled.

Exp: Let us see whether Carolina paid attention. Carolina, tell us what happened in the story.

Carolina: Oh, this is a story about a musician and a clown. I know what happened. He was riding a rocking horse, while a musician was playing his trumpet.

Target: No.

The two children who participated in this follow-up were tested in a single session 1 month after they had completed the test for Experiment 2. The follow-up test included three sentences violating Principle C and two filler sentences. The outcome was that children this time correctly answered *no* to all Principle C violations. This is consistent with the hypothesis that they had developed a strategy that considered just the last event acted out. In the case of ambiguous and control sentences, they would behave like the other children because the relevant stories composed a single event.

If these children were indeed answering on the basis of a "what comes last" strategy, as seems likely, we do not know why that would be so. At any rate, given that the answers of these children were not univocally interpretable, we did not include them in the third experiment.

5.3. Experiment 3

The third experiment is aimed at establishing whether children who respond to Principle C in "normal" cases are also sensitive to it in reconstruction contexts. The sentences we want to test are of the following form:

(53) In every pirate's barrel, with care (he) put a toy gun.

These sentences are structurally similar to sentences like (54), studied in the literature (e.g., by Lust et al. (1980)).

(54) Next to John, he saw a snake.

However, and crucially, we test the behavior of quantified NPs for the reasons spelled out in section 2. In fact, as we see, what emerges from our study, although going in the same general direction as Lust et al.'s (1980) results (i.e., early compliance with grammatical principles), also seems to show some intriguing differences that we discuss in section 6.

5.3.1. Participants. The participants for this experiment were the same 18 children and 16 adults that participated in the first experiment. The children were between 3;10 and 5;7, with a mean age of 4;6. The two children who answered incorrectly to Principle C sentences were not tested for the reasons indicated in section 5.2.5. Working with the same participants is what allows us to check whether there is any discrepancy in the ability to judge sentences involving backward anaphora and forward anaphora in Principle C environments.

5.3.2. Procedure. Children were tested using again the truth–value judgment methodology. In a warm-up session, we made sure that children understood the meaning of universal quantifiers. A couple of short stories were presented to the child. The puppet described each story at the end using a universal quantifier. For example, she would say, "Mommy has given a piece of fruit to each child" in a situation in which she had given fruit to all children except one who misbehaved. The puppet's statement was clearly false. Performing correctly at this task was a prerequisite for participating in the experiment. All children passed the test.

5.3.3. The session and the material. The children were tested in two experimental sessions lasting around 25 min each. During each session the child was told 6 stories, for a total of 12 stories. Stimuli included two types of sentences, given in (55).

(55) a. Le scimmie hanno nascosto il tesoro di ciascun bambino,
The monkeys have hidden the treasure of each child,
mentre dormiva.
while (he) was sleeping

b. Il tesoro di ciascun bambino, le scimmie lo hanno nascosto,
The treasure of each child, the monkeys it have hidden,
mentre dormiva.
while (he) was sleeping

The sentences in (55) are minimally different: In (55a) we have the basic Italian word order, whereas in (55b) the object has been fronted (with a resumptive clitic pronoun filling the object position). The construction in (55b) is known in the literature as Clitic Left Dislocation (see Cecchetto (in press) and Cinque (1990) for analyses). The sentences in (55) are both ambiguous: The null subject of the *while*-clause can either be bound by the quantifier *each child* (anaphoric reading)

or refer to some salient character (exophoric reading). Accordingly, these sentences have been tested in two contexts: one per reading. The procedure employed is the same as in Experiment 2. A mixed experimental design was adopted. Children were divided into two groups. The base group was tested with four sentences of type (55a); two sentences were presented in a context supporting the anaphoric reading and two in a context supporting the exophoric reading. The displaced group was presented with four sentences of type (55b), two in a context supporting the anaphoric reading and two in a context supporting the exophoric reading. All the contexts elicit a positive answer. Clearly, if both meanings of the sentences in (55) are available to the child, she is expected to answer *yes,* at least sometimes.

Besides the sentences in (55), the stimuli for both groups of participants included, crucially, sentences like (56).

(56) Nel barile di ciascun pirata con cura ha messo una pistola.
In the barrel of each pirate with care (he) put a toy gun

This sentence has a displaced constituent like sentence (55b), but in this case, the preposed quantifier cannot bind the subject pronoun of the main clause.

The procedure to test (56) was analogous to the one used in Experiment 2 for (43) (see the protocol in (48)). The story, reported in the protocol that follows, included a ghost, three pirates, three barrels, three toy guns, and three fishes.

(57) Protocol for testing the illicit forward anaphoric reading.
First part corresponding to the exophoric interpretation (he ≠ pirate)

Exp: This is a story about a ghost and three pirates, each having a barrel, a fish, a gun. The ghost wants to have some fun and decides to play a practical joke on the pirates, since they cannot see him. He goes near the first pirate and considers what to do.

Ghost: Look, I could hide this gun into the barrel, so that the pirate will not find it. [*The ghost thinks about it*] Oh, that is not a funny joke. I would rather take his fish home and eat it tonight.

The ghost repeats the same actions with the other two pirates and at the end has all three fishes.

Second part corresponding to the exophoric interpretation (he = pirate).

Pirate: Gee, someone stole my fish. I was stupid to leave it here where everyone could see it. Fortunately, they did not take my gun. I cannot leave it here anymore. It is better to hide it in the barrel.

The other two pirates do the same thing—hide the gun in their barrel.

Exp: Let us see whether Carolina paid attention. Carolina, tell us what happened in the story.
Carolina: Oh, this is a story about a ghost and each pirate. I know what happened. In the barrel of each pirate with care he put a gun.
Target: No.

In this situation, if the child knows Principle C, he or she should answer *no* most of the time because, in the first part of the story, the ghost only thought about putting the gun into the barrel, but in the end he did not and rather stole each pirate's fish. By contrast, if the child does not have Principle C, he or she will answer *yes* most of the time because this is the response corresponding to the last event watched (and it is natural to pick up a sentence-internal antecedent).

As in the first experiment, we ran four control sentences to discard conceivable alternative explanations. Two sentences of the type in (58) were presented after a context in which the smurfs were cleaning every child's toy while each child was not sleeping, but eating.

(58) I puffi puliscono i giochi di ciascuna bambina, quando
The smurfs clean up the toys of each girl, when
dorme.
(she) is sleeping

With this sentence, we wanted to discard the hypotheses that children answer by considering only the main clause or only the first clause or by using a N–V–N strategy. In each case, if children did not pay attention to the whole sentence, they should answer *yes.* In addition, two sentences of the type in (59) were used in a context in which, although the children were seated, the clowns took their toy car (rather than their bike).

(59) I pagliacci prendono la bici di ciascun bambino, quando
The clowns take the bike of each child, when
è seduto.
(he) is sitting

With this sentence, we intended to check whether children paid attention to the whole sentence. If they did not, they should give a positive answer. Both groups of children were presented with the same set of nonambiguous and control sentences. The stimuli were presented in a random order, with different orders for each child.

5.3.4. Results. Overall, all children answered correctly to nonambiguous sentences of the type in (56)—that is, they rejected these sentences 90% of the time. As for ambiguous sentences, they accepted the forward anaphoric reading

86% of the time and the exophoric reading 89% of the time. Recall that we divided the children into two groups: the base and the displaced. The latter group was presented with ambiguous sentences with the object displaced to a sentence-initial position, whereas the former was presented with ambiguous sentences with the object in the base position (this is the reconstructed position). The results of each group are as follows. The rate of correct answers of the base group to sentences of the type in (56) is 92%. For ambiguous sentences, this group accepted the anaphoric reading of (55a) 94% of the time and the exophoric one 83%. The rate of correct answers of the displaced group to sentences of the type in (56) is 89%. For ambiguous sentences, this group accepted the anaphoric reading of (55b) 83% of the time and the exophoric reading 89% of the time. All children responded correctly to the controls 96% of the time.

Overall, adults answered correctly to sentences of type (56) 98% of the time; they accepted sentences of type (55a or b) 75% of the time in the anaphoric reading and 34% of the time in the exophoric reading. They responded correctly to controls 97% of the time. Adults, like the children, were divided in two groups. The results of each group are as follows. For ambiguous sentences of the type in (55a), the base group accepted the anaphoric reading 75% of the time and the exophoric one 31%, whereas it rejected (56) on the anaphoric reading 94% of the time. The displaced group, which was tested with (55b), accepted the anaphoric reading 75% of the time and the exophoric one 37%, whereas it rejected (56) on the anaphoric reading 100% of the time. The results from children and adults are shown in Figure 2. Responses in the base and in the displaced condition are conflated.

No significant difference between children belonging to different age groups is found. The following are the children's explanations of why the snail was wrong after sentences of the type in (56):

(60) a. Dopo i pirati li hanno messi. Prima il fantasma ha rubato
After the pirates put them in. Before, the ghost stole
i pesci.
the fishes

b. Non gli ha messo la pistola dentro il barile, gli ha rubato
(He) did not put the gun into the barrel, (he) stole them
il pesce.
the fish

c. Voleva mettere la pistola, ma ha detto no e allora
(He) wanted to put the gun, but said "no" and then
si è preso il pesce.
(he) took the fish

As in the previous experiment, there is no significant difference between adults' and children's responses, with the exception of one case. Adults answered at

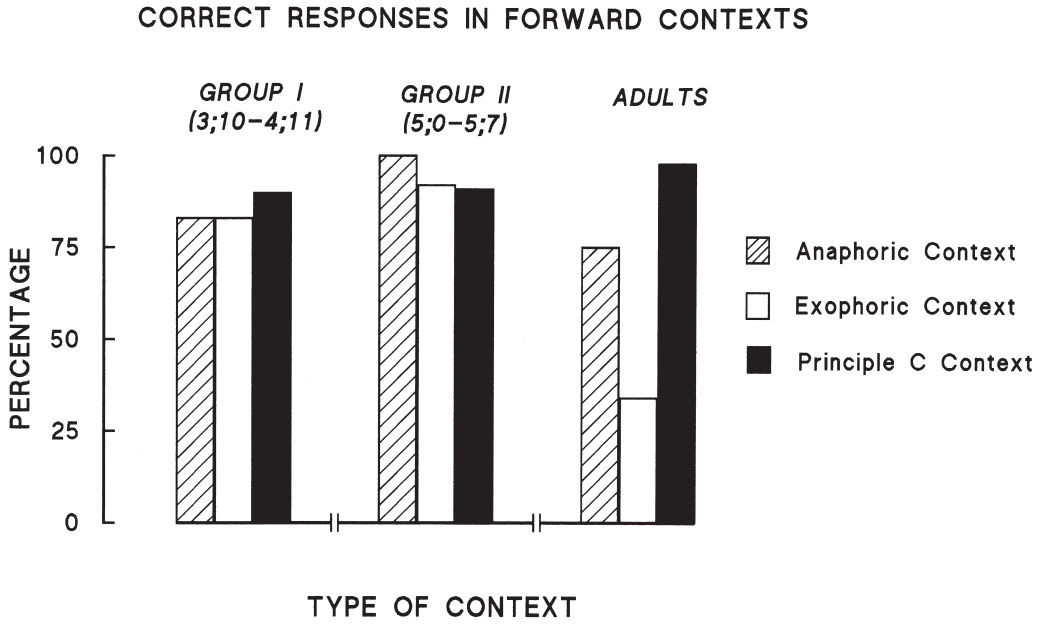

FIGURE 2 Percentage of correct responses by children and adults in forward contexts. Participants were divided into a base group (those tested with sentences like (56a)) and a dislocated group (those tested with sentences like (56b)). For each group, the figure displays the percentage of acceptance of the anaphoric and exophoric readings and the percentage of rejection of ungrammatical anaphoric reading (Principle C violations).

chance level to ambiguous sentences in contexts supporting the exophoric reading. This replicates the finding of Experiment 2.

6. DISCUSSION

Generally speaking, our results show that Principle C with quantified NPs is continuously operative in early Italian at least from age 3;10. They also show that there is no difference between backward and forward anaphora (in which the latter involve reconstruction) in cases of the following sorts. In particular, the direction of the relation between the antecedent and the pronoun does not affect children's performance, for they reject (61a) as much as they reject (61b).[8]

(61) a. He plays the trumpet while a clown rides a horse.
b. In every pirate's barrel, he put a gun.

[8]The sentence in (i) forms a minimal pair with (61b). In our material, we did not include (i) but did include (61a), which is parallel to it.

(i) He put a gun in every pirate's barrel.

We conclude that there is no child who rejects sentences like (61a) or (62) without also rejecting (61b), and vice versa.

Those who feel that the inductive basis provided by our results is insufficient to warrant our claim know what to look for to falsify it. The evidence available thus far supports the thesis that reconstruction is not learned. This in turn goes well with the line of research according to which there is no reconstruction as such. What happens is that at the relevant level, sentences like (61b) have the same structure as (62).

(62) He put a gun in every pirate's barrel.

Notice that we are not just claiming that Principle C is operative in both backward and forward anaphora cases, for this claim would still allow children to perform better in one case than in the other. We argue that at the relevant level in which Principle C applies, (61a) and (61b) have the same structure, and the distinction between backward and forward anaphora vanish. Our study, as with many recent findings, provides evidence of compliance with grammatical principles early on in child language. There are also a few other spin-offs of our results that are worth discussing.

An aspect of our experiments that deserves some specific discussion concerns the different behavior of children versus adults with respect to the exophoric reading in Experiments 2 and 3. Although in children we find a high acceptance of exophoric readings, the acceptance rate of such readings in adults is not different from chance. That is to say, in contexts designed to favor the exophoric reading, children accept it easily. Adults accept it at chance level in both forward and backward contexts. Our intuition tells us that such reading is perfectly grammatical, but in an experimental setting it is highly disfavored. There are various factors that may determine this state of affairs. It seems to be clear that there is a difference in behavior between children and adults and that grammar cannot be responsible for this difference by itself. Presumably there is a difference in the processing strategy. Take one of the relevant examples:

(63) While (he) was dancing, a clown was playing the guitar.

In the context provided for sentence (63) (see the protocol in (45)), there are two possible antecedents for the null subject: (i) the linguistic antecedent *a clown,* which, however, makes the sentence false, and (ii) the extralinguistic antecedent *a cowboy,* which makes the sentence true. For adults, evidently these two antecedents are equally salient, as they seem to be chosen at random. For kids, the antecedent that makes the sentence true is promoted to salience, and the other is discarded. Whether this is so (and why), or whether other factors specific to the nature of the null subject may also be playing a role, must be left to further research (see Lust, Chien, Chiang, and Eisele (1996), who discussed some results on Chinese, also a null-subject language, which might be interpreted as going in the same direction).

A further, even more speculative consideration emerging from our findings is the following. Employing the truth-value judgment task, Crain and McKee (1986) found that kids reject Principle C violations in sentences like (64) roughly 90% of the time (examples from Crain and McKee (1986)).

(64) a. He washed Luke Skywalker.
b. He ate the hamburger when the smurf was in the fence.

Interestingly, sentences involving Principle C violations with proper names in reconstruction contexts, like (30a) earlier, have never been tested using a truth-value judgment task.

(30) a. In Cookie Monster's mouth he put a candy.

What emerges from Lust et al. (1980), who use an act-out task, is that even though kids often reject sentences like (30a), they make a noticeable number of errors. According to Carden's (1986) estimate of Lust et al.'s (1980) results, children accept an anaphoric reading of (30a) between 23% and 60% of the time, depending on the testing condition.[9] In other studies we mentioned in section 4, higher percentages of acceptance of the anaphoric reading of (30a) were found. The question is whether, once we test (30a) with the same methodology we used to test (62b), the rejection rate of the anaphoric reading will not differ significantly for the two types of sentences ((30a) and (62b)). The question is interesting because we have found virtually no mistakes with quantificational antecedents in sentences like (62b), and Thornton (1990) also did not find mistakes in strong crossover questions (see (31)), just as no mistakes were found with Principle B contexts like (14b) repeated here:

(31) *I know who$_i$ he$_i$ said t$_i$ has the best smile.

(14) b. Everyone likes him.

The fact that an adultlike behavior was found by Crain and McKee (1986) with sentences like (64) signifies that children make no mistakes with either binding or coreference in such cases. However, this does not automatically entail that they do not make mistakes in cases like (30a). If they do, this will confirm that they treat coreference differently from binding (and what is special in (64) must have to do

[9]The 60% acceptance of the anaphoric reading of (30a) was found in a condition in which the test sentence was preceded by a pragmatic lead, which introduced the referent of the names used in the test sentence (i.e., (30a)). In this respect, this condition reproduces the discourse context created by our stories. It is remarkable that the acceptance rate of an anaphoric reading is only 10% for a sentence structurally similar to (30a), but with a crucial difference: The dislocated PP includes a quantifier rather than a name.

with processing factors, e.g., participants tend to assign an extrasentential referent to a pronoun when there is no antecedent). If they do not, this means that when it comes to Principle C, children have an adultlike behavior for both binding and coreference. This would make the fact that they do not make mistakes in Principle B contexts ever more puzzling. In either case there is something to find out.

In conclusion, we have seen that children behave just like adults with quantificational NPs in Principle C environments. We have also seen that this applies equally well to contexts that involve reconstruction and to contexts that do not. On one hand, this constitutes further evidence that Principle C is part of the initial state of the language learner; on the other hand, it constitutes novel evidence that there is no rule of reconstruction that needs to be separately learned. We have also encountered a number of further interesting questions (concerning coreference vs. binding) that this approach leads us to ask. This is a pattern we have come to be familiar with thanks to the generative enterprise and its recent developments: The dynamics between abstract linguistic principles and evidence from acquisition can indeed be very fruitful in finding out how language works.

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APPENDIX A

Follow-Up on Quantificational Indefinites

Two of the anonymous referees have pointed out that in all our stories the relevant characters (e.g., the clown in protocol (48)) were unique. This might support a referential interpretation of indefinites (or else make the use of the indefinite somewhat unnatural). If the indefinite is interpreted referentially (i.e., like a proper name of a salient object), then we could not be sure to have tapped the grammar of binding after all. Although not devastating, this would be a bit disturbing given the logic of our experiments.

The status of so-called referential indefinites is highly controversial. Fodor and Sag (1982), in an important article, indeed argued that indefinites can be interpreted just like proper names. However, their arguments have been shown not to be tenable by much subsequent literature (see, e.g., Abusch (1994), Reinhart (1997), Winter (1997), and references therein). According to all the works just cited, indefinites always wind up being existentially closed and, hence, quantificational.[10]

Be that as it may, to avoid controversy, we have run a follow-up with the goal of showing that children can interpret indefinites quantificationally. In this follow-up, the relevant characters are no longer unique and the alleged referential interpretation of indefinites is uncontroversially out of the question. In particular, we have used stories just like (48) but with three musicians. Initially they are introduced to the child; two of them go in a car while the other plays the trumpet. At this point the story goes on as before, and sentence (43) is offered by the puppet as a description of what went on. Given the presence of three musicians, all having a certain salience, the possibility of interpreting the indefinite as referential (granting, for the sake of the argument, that such uses exist) would appear to be disallowed or at least disfavored. We tested three 5-year-old Italian learners with two sentences of the kind in (43), in which the backward anaphoric reading is illicit, and two filler sentences. Children rejected the anaphoric reading of (43) 83% of the time. Because the context made a referential interpretation of indefinites infelicitous—the relevant character was not unique anymore—children must have treated indefinites as quantified expression (i.e., (43)). Hence, it is not unlikely that in our second experiment children may have also interpreted indefinites as quantifiers. If this is the case, then we have indeed tapped binding even in this experiment and not coreference.

APPENDIX B

Experiment With Adults Testing the Role of Plausible Dissent

It is known that children may not perform very well in a linguistic task when the pragmatic setup is not felicitous (see Crain and Thornton (1998), Hamburger and Crain (1982)). The truth–value judgment method (Crain and McKee (1986)) that we used in our comprehension experiments allows one to overcome such pragmatic infelicity by incorporating the condition of plausible dissent, a principle of pragmatic relevance that we discussed in section 5.2.3.

[10]Kratzer (1998) is an exception to this trend; although accepting most of the criticisms to Fodor and Sag (1982), she maintained that there are interpretations of indefinites that are not existentially closed.

It has been found that adults may be more well behaved than children, for they may provide correct linguistic answers even when the pragmatic setup is infelicitous because the condition of plausible dissent is not honored. This is because adults, unlike children, may accommodate more easily a pragmatically inadequate setup. We wanted to measure the cost of this accommodation. Therefore, we ran an experiment with adults modeled after our second experiment, except that the condition of plausible dissent was not satisfied. If adults did poorly, this would demonstrate the importance of including the condition of plausible dissent in experiments with children. We tested 21 undergraduate students with six sentences, three of the type in (42) and three of the type in (43), repeated here.

(42) Mentre ballava, un pagliaccio suonava la chitarra.
While (he) was dancing, a clown was playing the guitar

(43) Andava sul cavallo a dondolo, mentre un musicista
(He) was riding a rocking horse, while a musician
suonava la tromba.
was playing the trumpet

Adults were told stories that a puppet described at the end by using either (42) or (43). As usual, the adults' task was to say whether the puppet was right or wrong. For (42), we only tested whether adults had access to the anaphoric reading of the pronoun by using the same protocol employed in our second experiment (see (44)). For (43), we modified the protocol in (48), first by using only one character—the musician—and second by only acting out the second event (in which the musician plays and goes on the rocking horse). In this way, we only provide one antecedent for the null pronoun in (43) and in so doing we do not make clear why the sentence can be false (see the discussion surrounding 5.2.3)—that is, we have created a context that is pragmatically infelicitous. If adults can easily accommodate such infelicity, we expect that they should abide by the grammar and say that (43) is false as a description of a situation they have seen.

Overall, adults accepted the anaphoric reading of (42) 95% of the time, but they also accepted this same reading of (43) 59% of the time. The difference is statistically significant, $\chi^2(1, N = 21) = 42.34$, $p < .005$, indicating that adults clearly discriminate between (42) and (43). However, the rejection rate of the anaphoric reading of (43) is much higher in this experiment than it was in our second experiment, in which it was only 6%. The different rejection rate of the anaphoric reading of (43) in the two experiments is statistically significant, $\chi^2(1, N = 21) = 21.58$, $p < .005$. This outcome clearly shows that the method one uses may significantly affect the results one obtains; it indicates that children's performance and even adults' performance drop when the pragmatic conditions are not felicitous. We think that this finding strengthens the importance of testing children in pragmatically felicitous contexts, as widely shown by Crain and Thornton (1998).

APPENDIX C

Knowledge of Grammar or Knowledge of Stories?

A reviewer objected that children's rejection of (43) may not result from knowledge of Principle C, but from knowledge of stories (see also Crain and Thornton (1998) for additional discussion). In the story we presented to the child (see (48)), we introduce two potential referents for the pronoun in (43): the clown and the musician. Hence, the child assumes that both characters have to be mentioned in the sentence in (43), and when the child interprets (43), he or she reasons as follows. Because one character is overtly mentioned—the musician—the pronoun must refer to the other. In this way, the child assigns an interpretation that conforms to Principle C, but his or her reasons for doing so is not knowledge of Principle C but the assumption that a description of a story must mention all the participants in the story. To discard this explanation, we run a follow-up in which we presented to four children between 4;7 and 5;7 a story including three pirates and a smurf, all having a toy car. During the story, the pirates decide to hide their cars and so does the smurf. The puppet describes what has happened with the following sentence:

(1) Questa è una storia sui pirati e su di un puffo.
This is a story about the pirates and a smurf.
So che cosa è successo. Ciascun pirata ha nascosto
I know what happened. Each pirate has hidden
la sua macchina.
his car.

The pronoun *sua* 'his' can either be bound by the quantified NP *each pirate* or refer to the smurf; that is, the sentence is ambiguous. It can mean that every pirate has hidden his own car or that he has hidden the smurf's car. If children assume that all the characters present in the story must be referred to in the sentence, they should always say that the puppet's statement is false because each pirate did not hide the smurf's car. By contrast, if they do not make this assumption, they can say that the sentence is true, at least sometimes. All four children tested judged the puppet's description as true; that is, they interpreted the pronoun *sua* 'his' as bound by the quantifier *each smurf.* This demonstrates that children do not assume that all characters involved in the story are mentioned in the sentence.