ABSTRACT

Title of Dissertation: PUTTING CHILDREN IN CONTEXT

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Studies of adult sentence processing have established that the referential

context in which sentences are presented plays an immediate role in their

interpretation, such that features of the referential context mitigate, and even

eliminate, so-called 'garden-path' effects. The finding that the context ordinarily

obviates garden path effects is compelling evidence for the Referential Theory,

advanced originally by Crain and Steedman, (1985) and extended in Altmann and

Steedman (1988).

Recent work by Trueswell, Sekerina, Hill and Logrip (1999) suggests,

however, that children may not be as sensitive as adults to contextual factors in

resolving structural ambiguities. This conclusion is not anticipated by the

Referential Theory and it also runs counter to the Continuity Assumption, which

supposes that children and adults access the same cognitive mechanisms in processing language.

The purpose of this work was to reexamine the observations that have led researchers to conclude that children, unlike adults, may lack sensitivity to features of the referential context in comprehension and ambiguity resolution. A series of experiments has been conducted to evaluate this conclusion. The findings show that the performance systems of children and adult differ minimally. Children are sensitive to the same features of the referential context as adults are, and they make use of the context to resolve structural ambiguities in sentence interpretation.

In addition, the present study provides evidence in favor of children's pragmatic and semantic knowledge.

PUTTING CHILDREN IN CONTEXT

Experimental Studies on Children's Interpretation of Definite Noun Phrases

By

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Dissertation submitted to the faculty of the Graduate School of the
University of Maryland, College Park in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2005

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TABLE OF CONTENTS

Chapter I

1.1 Introduction

In recent years, a central topic in psycholinguistic research has been the study of

how language is processed on-line (e.g. Frazier and Fodor, 1978; Marslen-Wilson,

1973, 1987; Tanenhaus & Trueswell, 1995). Many experimental investigations of

human sentence processing have shown that language comprehension takes place

incrementally. That is, listeners do not wait until they reach the end of a sentence

before they begin to compute an interpretation. Rather, listeners incrementally

commit to an interpretation as the linguistic input unfolds in real time. As a

consequence, in case of temporarily ambiguous sentences, listeners often

experience the feeling of having been led down the 'garden path' (Bever, 1970).

In the presence of a temporary ambiguity, listeners may assign an interpretation

that later, as the rest of the sentences has unfolded, turns out to be unworkable and

must, therefore, be abandoned (in favor of an alternative interpretation). Bever's

(1970) famous sentence in (1) provides us with a clear example.

(1)   The horse raced past the barn fell.

As the sentence in (1) is uttered, listeners tend to interpret the verb *raced* as the

main verb of the sentence thus experiencing a garden-path when the final verb *fell*

occurs. The garden-path arises because of an incorrect resolution of the temporary

ambiguity associated with the verb *raced,* which can be interpreted either as a

simple past tense or as a past participle. The local ambiguity of the verb *raced* is

so strongly resolved in favor of the simple past interpretation that subjects

typically fail to recognize the grammaticality of (1). Such sentence is indeed

perfectly grammatical: it suffices to replace the verb *raced* with the unambiguous

past participle *driven*, as in (2), to reveal the grammaticality of (the structure of)

sentence (1).

(2)   The horse driven past the barn fell.

Other examples of grammatical structures which give rise to garden-path effects

include ambiguous sentences like (3):

(3)   Jeff opened the door with the key.

There are two ways we can interpret the sentence in (3), which ultimately depend on the way the Prepositional Phrase (PP) *with the key* is interpreted. On one interpretation the PP *with the key* specifies the instrument with which the action of 'opening' has been accomplished, as paraphrased in (4).

(4)   Jeff opened the door *using* the key

Under this interpretation the PP is syntactically attached high to the verb (VP-attachment) and is interpreted as a modifier of the Verb Phrase (VP). Alternatively, the PP *with the key* can be interpreted as a modifier of the preceding Noun Phrase (NP) *the door*, specifying a property of the door that has been opened, as paraphrased in (5).

(5)   Jeff opened the door *that had* the key (in the lock).

Under this interpretation, the PP is attached low to the NP *the door* (NP-attachment). Many empirical studies have established that listeners have a strong preference towards VP-attachment of the PP *with the key* (Rayner, Carlson and Frazier, 1983; Taraban and McClelland, 1988).[1] This conclusion is supported by

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[1] A strong bias towards VP-attachment has been uncovered in different kind of constructions (e.g. Ferreira & Clifton, 1986; Frazier & Rayner, 1982; Rayner et al., 1983; Rayner, Garrod, & Perfetti, 1992).

the intuition that listeners would experience a garden-path if the final NP *the key* is replaced with a different NP that is less likely to be used as an instrument, as exemplified in (6).

(6)   Jeff opened the door *with* the rusty lock.

The preference for VP-attachment predicts, in fact, that upon hearing the preposition 'with', listeners would interpret that prepositional phrase as a modifier of the VP; as a consequence they will expect the following NP to refer to an object that could serve that purpose. This is why a garden-path arises when, for example, an NP like *the rusty lock* is encountered. At this point listeners have to reconsider their 'decision' about the PP *with the rusty lock* and attach it to the NP *the door* in order to assign a more plausible interpretation to the sentence.

Various hypotheses about ambiguity resolution, which underlie different models of sentence processing, have been proposed to account for the systematic misinterpretation of sentences like (6). These hypotheses differ depending on which factors are taken to influence the parser in resolving syntactic ambiguities (and in which order).[2] One of the first attempts to motivate VP-attachment

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[2]Models of language processing also differ along other dimensions. First, models differ in whether they assume that a single syntactic interpretation is initially considered (serial models) or whether multiple interpretations are considered in parallel. Second, they differ on the extent to which processing mechanisms are modular. Existing proposals vary from models that assume that the human sentence processing mechanism consists of completely encapsulated modules, i.e., with

preference is syntactic in nature. In what has been known as the Minimal

Attachment Principle, Frazier (1978; 1987)[3] claimed that VP-attachment is to be

preferred over NP-attachment because the syntactic structure associated with VP-

attachment is simpler (by virtue of containing less syntactic nodes). The parser

will thus prefer the simpler structure in an attempt to reduce memory load. Other

proposals draw upon the notion of thematic roles assigned by predicates. For

example, according to some authors the parser prefers to fill the theta grid of a

predicate as soon as possible, leaving as few unassigned theta roles as possible

(e.g. Pritchett, 1988, 1992; Gibson 1991; Weinberg, 1992).

For the time being, we will not try to discriminate among the different

models of ambiguity resolution in language processing. Rather we will consider

the claim that the problems normally encountered with sentences such as the ones

given above could be overcome in the appropriate *referential contexts* (Crain and

Steedman, 1985).

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every module being informationally impermeable to the work of the others, to models which argue
for a immediate, almost word-by-word interaction among different modules. We will endorse the
view that language understanding is incremental, a word-by-word interaction of information
provided by syntax, semantics, pragmatics (context), and we will return on this topic shortly.
[3] But see also Kimball (1973).

1.2 The role of extra-sentential context

Thus far, the only information we have considered as relevant for the interpretation of a syntactically ambiguous sentence is the information derived from within the sentence itself. The same goes for sentences that are only temporarily ambiguous. However, a further source of information that can influence the way a sentence is processed and interpreted comes from the context, linguistic or 'real', in which the ambiguous sentence occurs. We now illustrate the role played by the context in ambiguity resolution as proposed by Crain and Steedman (1985). The main implication subsumed by these authors is that there are no purely structural garden path sentences—that is garden path effects that cannot be eliminated by manipulating the semantics of the sentence or the context in which the sentence is uttered.

1.2.1 The Principle of Referential Success

In considering syntactically ambiguous sentences which often induce garden path effects, Crain and Steedman (1985) examined whether the different syntactic structures were associated with different discourse functions. To illustrate, let us consider (7).

(7)   The horse raced past the barn fell.

At the verb *raced*, the parser has a choice between complicating the syntactic structure of the definite NP and simply treating the definite as an argument of the verb. Once the discourse function is taken into consideration, the simple NP structure might be preferred not for syntactic reasons, as claimed by the proponents of the syntactic analyses, but rather because the use of the alternative analysis, the restrictive relative clause, carries some presuppositions that must be satisfied. Now, in absence of the appropriate context those presuppositions might not be satisfied. This is why, according to Crain and Steedman (1985), the modification interpretation is dispreferred. This follows from the Principle of Parsimony in (8).

(8)   *The Principle of Parsimony*

        If there is a reading that carries fewer unsatisfied but consistent

        presuppositions or entailments than any other, then, other criteria of

        plausibility being equal, that reading will be adopted as most plausible by

        the hearer, and the presuppositions in question will be incorporated in his

        or her model.   (Crain and Steedman, 1985; p. 333)

To illustrate, let us consider (1) here reported as (9) with his paraphrase in (10) :

(9)   The horse raced past the barn fell.

(10)   The horse that raced past the barn fell.

Despite the grammaticality of (9), listeners tend to judge that sentence as ungrammatical as they reach the verb *fell*. Having interpreted the VP *raced* as the main verb, listeners experience a garden-path at the occurrence of *fell* because this verb does not constitute a good continuation of the sentence. Notice that, had listeners interpreted the VP *raced* as a modifier of the definite NP *the horse* as paraphrased in (10), they would not have experienced any problems at the occurrence of the verb *fell*. The question is why listeners do not commit to (or even entertain) the modifier interpretation since the beginning, in experiments documented in the literature prior to Crain and Steedman (1985). According to Crain and Steedman the answer involves two factors: first, the sentence has been presented in a null context,[4] and second the modifier interpretation (or reduced relative clause interpretation) carries some presuppositions (which might fail to be

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[4] Most of the early experiments on sentence processing have been conducted using a self paced reading technique which requires subjects to read sentences word-by-word appearing on a computer screen. No context was provided.

satisfied in a null context or in the mental model that the listeners constructs as the sentence unfolds).

Let us start from the notion of null context. According to Crain and Steedman (1985), the so called null context does not exist. Even if a sentence is presented outside of an explicit context, it is reasonable to assume that listeners conjure up a mental context as the sentence unfolds over time. That is, when presented with a sentence like (9), listeners will assume the existence of a horse upon hearing the definite NP *the horse*. When the verb *raced* appears, there are two alternatives. First, listeners can interpret this verb as the main verb of the sentence. Differently, they can take this verb as a modifier of the definite NP *the horse*. Notice that only the former interpretation would allow the listeners to maintain the mental context they conjured up (i.e., there is only one horse). By contrast, the reduced relative clause analysis would require to enrich the mental context. Because of the way restrictive relative clauses are ordinarily used, Crain and Steedman (1985) argue that entertaining the reduced relative clause would force a modification of the (mental) context such that multiple horses are available and only one of these horses was raced past the barn. At this point the main-verb reading is selected because it does not require any modification of the (mental) context. Here is how Crain and Steedman (1985) define this mechanism:

(11)   *Principle of Referential Success*

If there is a reading that succeeds in referring to an entity already

established in the hearer's mental model of the domain of discourse, then

it is favored over the one that does not.

The Principle of Referential Success as defined here is subsumed by the more

general Principle of Parsimony given in (8). In fact, if one reading succeeds in

referring to an entity already established in the mental model, then this reading

does not implicate any change to the mental domain of discourse.

To recap, the main assumption of the referential theory is that, when

presented with temporarily ambiguous sentences, the parser chooses among

possible readings by evaluating in which contexts those readings are normally

intended. Thus, there are no intrinsically garden-path inducing structures, but

rather, any given structure can be easy if a sentence which can have that meaning

is uttered in the appropriate context or hard if the relevant sentence is uttered in

the so-called null context or in infelicitous contexts.

The Referential theory makes two predictions: first, it predicts that a

sentence like (9) would be easily understood if presented in the right context (i.e.

one with multiple horses) and second, it also predicts that a structure that is

usually easy to understand in a null context will be hard to access if uttered in a

context that is biased towards a competing reading. In some cases, the relevant

context can be 'triggered' by linguistic material contained in the target sentence itself. As an example consider the following sentence:

(10)   Only horses raced past the barn fell.

The structural analyses predict that listeners will interpret the verb *raced* as the main verb of the sentence as illustrated above. By contrast, the Referential Theory proposed by Crain and Steedman (1985) predicts that a modifier interpretation will be selected. Upon hearing *only horses*, listeners will assume the existence of a set of horses. In addition, given the semantic properties of the focus operator *only*, the listener knows that two sets will ultimately have to be contrasted. One possibility is to contrast the set of horses, already established, with other entities which have to be introduced in the mental model, an operation that involves an enrichment of the mental model. Another possibility is to single out a subset of the horses. The Principle of Parsimony directs the parser towards the latter possibility because it is the one that does not require adding other entities beyond those that already had to be postulated upon hearing the sentence up to that point. In this case the listener will expect the continuation of the sentence to specify which property can be used to differentiate the two sets of horses being contrasted. The verb phrase *raced past the barn* serves this purpose. In fact, by interpreting the verb phrase *raced past the barn* as a modifier of the preceding NP

horse, the set of horses will be divided into two subsets, namely the horses that were ridden past the barn and those that were not. For this reason, no garden path is expected in a sentence like (10) according to the referential theory. To test these predictions, Ni, Crain and Shankweiler (1996) conducted a series of experiments monitoring subjects' eye movements during a reading task. The experiment included sentences like the following.

(11)   Only businessmen loaned money at low interest were told to record their expenses.

(12)   The businessmen loaned money at low interest were told to record their expenses.

(13)   Only wealthy businessmen loaned money at low interest were told to record their expenses.

As illustrated for (10), sentences (11) through (13) are temporarily ambiguous: the verb *loaned* can be understood as a simple past tense or as the past participle of a reduced relative clause modifying the NP *businessmen*. The latter, but not the former analysis will give rise to a garden-path at the later occurrence of the verb *were told*. However, while a garden-path effect is expected in (12), this is not the

case for (11). In (11), in fact, the presence of the focus operator *only*, which requires a contrast set, should lead the listeners towards a modifier interpretation of the verb *loaned*. The results were as anticipated. The presence of the focus operators, as in (12), dramatically reduced the difficulty normally encountered with sentences like (11). In addition, when the focus operator was present in sentences that also include a pre-nominal modifier, as in (13), the difficulty reemerged. In this case, the prenominal adjective (modifier) offered an alternative way to set up the two contrast sets required by *only*, namely a set of wealthy businessmen as contrasted to a set of not wealthy businessmen, before the ambiguous verb *loaned* occurs. Hence, having already established the relevant contrast set, upon encountering the verb *loaned* there was no reason to entertain the modifier interpretation.

The relevance of these experiments is twofold. First, they show that the difficulty of so called garden-path inducing sentences can be overcome if such sentences are uttered in the appropriate context. Second, the results show that even structures that are ordinarily preferred may turn out to be unexpectedly hard to process in specific contexts. Taken together the findings suggest that "there may be *no* intrinsically garden-pathing structures whatever, but rather that, for any give sentence there are certain contexts (including the null context) which induce garden paths, and certain others which do not" (Crain and Steedman, 1985; p.345).

Numerous empirical studies have now been conduced to evaluate the extent to which initial parsing decisions are influenced by the referential context. Although the role of context in facilitating the processing of otherwise difficult sentence has been recognized, the exact stage at which the context is operative is still source of considerable disagreement. In particular, one line of research argues that context may have a very early effect, preventing the parser to entertain syntactically available (and possibly preferred) structures. By contrast, a different line of research would attribute a much weaker function to context in sentence processing: the function of facilitating re-analysis after a garden path is experienced. The lack of consensus mostly derives from experimental results pointing in different direction. Whereas some studies have found clear effects of the referential context (e.g., Altmann and Steedman, 1988; Altmann, Garnham and Dennis, 1992; Tanenhaus, Spivey-Knowlton, Eberhard and Sedivy, 1995; Spivey-Kwnolton and Sedivy, 1995 and Sedivy, 2002), others have found weak or delayed effects (e.g., Ferreira and Clifton, 1986; Clifton and Ferreira, 1989; Spivey-Knowlton and Sedivy, 1995). As a potential source of the conflicting results, Tanenhaus et al. (1995) drew attention to the fact that most - if not all - of these studies involved experimental techniques which made use of printed text and in which the context was set up or created by linguistic material preceding the appearance on a screen of the target sentence. It has been pointed out by Clark (1992) that linguistically introduced context cannot be equated to referential

context. The notion of referential context in fact requires that the participants to a conversation have access to the same entities, as well as sharing the same presuppositions and the same understanding of the situation. On this scenario, a failure in showing effects of context for ambiguity resolution in previous studies might just be due to uncontrolled features of the poorly defined context.

In recent years a new experimental technique has been developed which combines the possibility to use measures that are closely time-locked to the linguistic input and the possibility to use 'real' referential context (Tanenhaus et al., 1995:Truesweel et al., 1999; Sedivy, 2002; Spivey et al., .2003). These studies argued that the referential context plays a crucial role in the process of ambiguity resolution.

1.3 The role of extra-linguistic context

In the previous sections we have reviewed some of the literature on sentence processing focusing on the factors that affect the resolution of temporarily syntactic ambiguities. One such factor originally proposed by Crain and Steedman (1985) is constituted by the referential context. One of the earliest experiments

conducted using a free head eye-tracker technique[5] demonstrated that the non

linguistic information provided by the context has an effect on how the linguistic

information provided by the sentence is evaluated. For example, Tanenhaus et al.,

(19995) conducted an experiment in which subjects were given instructions such

as (14):

(14)   Touch the starred yellow square.

The instruction in (14) was given relative to a set of four different blocks which

could differ for marking, shape or color. The findings suggest that subjects fixate

on the intended object (the referent for the NP *the starred yellow square*)

immediately at the end of the word that uniquely singled out the referent in the

context. In other words, depending on the objects in the context, subjects were

able to identify the referent of the NP (the striped yellow square) even before

hearing the noun *square*. For example, subject fixate on the target object

immediately after hearing *starred* if only one of the objects was starred, and after

yellow if two objects were starred but only one of them was yellow.

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[5] Subjects participating in this kind of tasks usually wear a light head-set on which two cameras are mounted. One camera (i.e., the scene camera) records the scene from the subject's point of view. The second camera, (i.e., the eye camera) determines the subject's eye position by monitoring the location of the center of the pupil and the corneal reflection. The data from the two cameras are then combined by computer software, so that the experimenter can determine where the subject is looking as the auditory stimuli are presented.

Another finding was that the visual context affected the resolution of a temporary ambiguity within a single word (Tanenhaus, Spivey-Knowlton, Eberhard and Sedivy, 1995). Let us consider the word *candy*. Upon hearing the first syllable of this word, the input is consistent with multiple words, for example words like *candy* or *candle* or *candid*. Subjects were instructed to *Pick up the candy* relative to a context that contained different objects Sometimes the context contained two objects whose names begin with the same sound as the name in the target (i.e., a candy and a candle); sometimes, only one such object was present (a candy). The results show that the subjects were able to identify the target object before hearing the end of the word, when no other object whose name begin with the same sounds, was present in the context. These set of findings provides compelling evidence in favor of a rapid integration of information provided by the referential context and linguistic information.

As a further step, Tanenhaus et al. (1995) investigated whether contextual information also affects the way temporarily syntactic ambiguities are resolved. Recall that the importance of the extra-linguistic material, such as contextual information, has been questioned by the proponents of the autonomous view of the grammatical structure. The strongest evidence in favor of a strictly syntactic analysis of sentence processing, has come from studies involving temporarily syntactic structures with a strong bias towards one interpretation that persist even when the preceding linguistic context supported the alternative analysis (see

Spivey-Knowlton and Sedivy, 1995 for a review). However, as observed earlier, Tanenahus et al. (1995) claimed that the context presented under those conditions might not have been immediately accessible to subjects. This said, the rationale behind the design of the experiment conducted by Tanenhaus et al. (1995) was to show that when the context is immediately accessible, it can lead the subject towards the (syntactically) dispreferred analysis of temporarily ambiguous sentences. Moreover, this result can be achieved even for those ambiguous sentences which exhibit a strong syntactic preference, such as (15):

(15)   Put the apple on the towel in the box.

This sentence contains a temporary syntactic ambiguity because the prepositional phrase (PP) could either be attached to the verb phrase (VP) *put…*or to the noun phrase (NP) *the apple*.[6] If the listener attaches this phrase to the NP, then *on the towel* is interpreted as modifying the NP *the apple*, thus indicating which apple to move (i.e., the apple that is on the towel). However, if the PP is attached to the VP, then it is interpreted as modifying the VP *put...* Here, the NP within the PP receives the thematic role of *destination* and specifies the destination of the action

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[6] A third possibility is actually available: the PP *in the box* might be attached to the NP *towel*, thus specifying the location of the towel onto which the apple has to be put. We will not discuss this third interpretation, since no experimental condition was meant to make it contextually available. Furthermore, the reading under consideration was made unavailable in later studies when the preposition in was changed to into, e.g., *Put the frog on the napkin into the box.*

(i.e., where to put the apple). Reading time studies with sentences containing this type of ambiguity consistently found that, when sentences are presented in isolation, people show a general preference for attaching the ambiguous PP to the VP rather than to the NP, thus incurring in a garden-path when encountering the second PP *in the box* (Ferreira and Clifton, 1986).

As illustrated in section 1 different explanations have been proposed for the source of this attachment preference outside of context. One such explanation, the Minimal Attachment Principle (i.e., Frazier, 1987), claims that VP-attachment results in syntactically simpler configurations, where syntactically simpler is defined in terms of the number of nodes necessary to build the relevant structure. Other proposals draw upon argument structure and assume that the VP-attachment preference follows from a parsing principle that instructs the parser to assign the theta roles associated with a verb as soon as possible, all other things being equal (Gibson, 1991; Gorrell, 1995; Weinberg, 1992, among others). In the case at end, the English verb *put* assigns three theta roles. For our purposes we can concentrate on the Theme role and a Destination role. The parser assigns the Theme theta role to the NP *the apple* and it assigns the Destination theta role to the first PP *on the towel* in order to discharge the theta roles associated with the verb *put*. In contrast with these structural influences on parsing, which operate essentially independently from any context, the referential theory predicts that the attachment preference for the PP for temporarily ambiguous sentences like the

one in (15) could shift from VP-attachment to NP-attachment depending on the

context. That is to say, some contexts favor the VP-attachment interpretation of

the PP *on the towel*; others favor the NP-attachment. To evaluate these

predictions, Tanenhaus et al. conducted an eye-tracking experiment. Subjects

were given instructions such as (15) (here reported as (16)) relative to two

different contexts (see Figure 1 and Figure 2, taken from Tanenhaus et al., 1995)

which were meant to support different attachment preferences for the first PP.

Following the authors, we will call the two scenarios 1-Referent Context and 2-

Referent Context.

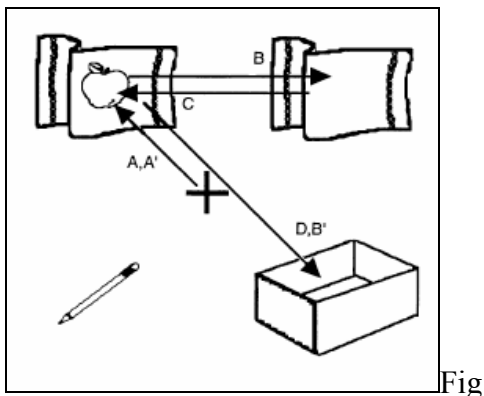(16)   Put the apple on the towel in the box.

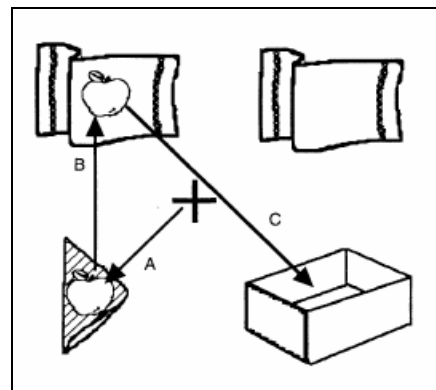

Figure 1: one referent context

Figure 2: two-referent context

According to Tanenhaus et al., the one-referent context, (Figure 1) supports VP-attachment, while the two-referent context (Figure 2) supports NP-attachment. Let us illustrate what the Referential Theory, illustrated in the previous section, has to say about the two contexts employed in the Tanenhaus et al. study (1995). For purposes of exposition we will call a definite NP, *simple* definite NP, when it is formed by the definite article and the head noun, as in *the apple;* and *complex* definite NP, when it contains a modifier Interestingly, in a sentence like *Put the apple on the towel into the box*, interpreting the PP *on the napkin* as a destination of putting event amounts to treating the definite NP *the apple* as a *simple* definite NP. By contrast, interpreting the PP *on the towel* as a modifier of the definite NP *the apple* equals to treat that NP as a *complex* definite NP, *--the apple (that is) on the towel.*

As we have seen earlier, Crain and Steedman (1985) claim that *simple* definite NPs, i.e. *the apple*, and *complex* definite NPs, *the apple on the towel*, carry different presuppositions.[7] A *simple* definite NP presupposes that there is a single entity that could serve as referent (i.e., it satisfies the property expressed by the head noun). This has been called the presupposition of Uniqueness of the definite determiner (see Heim, 1982).[8] So in the case at hand, the definite NP *the apple* presupposes that there is a single apple in the context. Differently, a

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[7] Technically speaking, one should speak of the number of objects that need to be presupposed rather than the number of presuppositions.
[8] It is generally assumed that a definite NP must refer to a unique referent already established in the context or discourse model (see Heim, 1982)

complex NP presupposes that there are multiple referents (which satisfies the property expressed by the head noun), but only one of those entities satisfies the property expressed by the modifier. So, the *complex* definite NP *the apple on the towel* presupposes the existence of multiple apples, only one of those is on the towel. Thus, the *simple* definite NP *the apple* is felicitous relative to a context if there is only one apple (cf. 1-referent context), the presupposition of Uniqueness associated with the definite determiner being satisfied[9]. If, on the contrary, multiple apples are present (cf. 2-referent context), the presupposition of Uniqueness is not satisfied. Following the Principle of Parsimony of the Referential Theory, this interpretation of the definite NP must then be abandoned in favor of another interpretation which carries less unsatisfied presuppositions. Interpreting the definite NP *the apple* as the *complex* definite NP *the apple on the towel* serves this purpose. In fact, the presence of two apples in the context, only one of which is on a towel, allows the listener to satisfy the presupposition associated with the use of a *complex* definite NP. Thus, this interpretation of the definite NP must be chosen. Let us recall, that in a sentence like *Put the apple on the towel into the box*, the definite NP is interpreted as *simple*, i.e, *the apple*, if the PP *on the towel* is attached directly to the VP *put*, but it is interpreted as *complex*, if that PP is attached directly to the definite NP, i.e., *the apple on the towel*. So, in

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[9] We will see later in this work that this is not completely true and things get more complicated. However, since we are just illustrating the reasons behind the study here reported, we will leave our criticism for the following chapters.

the end the difference in interpreting the definite NP boils down to the difference as to where attach the first PP *on the towel*.

Upon hearing the NP *the apple* subjects can immediately identify the object to be moved because there is only one apple in the context. Thus, having decided which object to move, subjects are likely to interpret the following PP *on the towel* as a destination[10]. On the other hand, in the 2-Referent Context (Figure2) upon hearing the NP *the apple* subjects cannot identify the object to move since that noun phrase could refer to either of the two apples in the scene. Thus, subjects will expect the following linguistic material to provide relevant information about which apple is intended to be moved. The incoming PP *on the towel* could be used for this purpose if interpreted as a modifier for the NP the frog (NP-attachment). NP-attachment is thus predicted in the two-referent context. However, if the initial parsing of the sentence is syntactic in nature, as claimed by the syntactic models of sentence processing, subjects should still (although briefly) entertain the VP-attachment analysis and interpret *on the towel* as a possible destination.

The results from the experiment conducted by Tanenhaus et al. (1995) exhibit different patterns of fixation for the two visual contexts. In particular, in the 1-Referent Context, subject looked at the empty towel, immediately after

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[10]The choice to attach the PP *on the towel* to the VP *put* in this context could be explained by any of the syntactical account illustrated in this chapter. We will return to this subject in the next chapter where we will also illustrate in details what the Principle of Referential Success assumes for the ambiguity of a sentence like (16).

hearing the PP *on the towel*; this indicates, according to the authors, that the subjects were interpreting that PP as destination (VP-attachment). By contrast, in the 2-Referent Context subjects almost never looked at the empty towel. Furthermore, there was no difference in eye-movements when subjects were responding to the target sentence *Put the apple on the towel in the box* as compared to the unambiguous instruction *Put the apple that is on the towel in the box*. The results were taken by the authors to indicate that participants immediately interpreted the PP *on the towel* as a modifier of the preceding NP *the apple*. Given the findings, Tanenhaus et al. (1995; p. 1634) conclude that "referentially relevant nonlinguistic information immediately affects the manner in which the linguistic input is initially structured."

It is time to take stock. We started this chapter by highlighting the relevance of temporarily ambiguous constructions for understanding the mechanisms that underlie the processing of sentences. We presented different proposals which differ relatively to the role played by extra-linguistic material (i.e., referential context) in resolving temporary ambiguity. In light of many experimental investigations on human sentence processing, there seems to be evidence that the process of language comprehension takes place incrementally and that linguistic and contextual information is integrated as the linguistic input is processed. However, this regards the way adults process the language. Nothing has been said about how children accomplish the same goal.

1.4 Processing abilities in children

The question of how children process sentences in real time has begun to attract a lot of interest in recent years. Until recently, however, little was known about children's processing abilities in general, and about how children resolve temporary syntactic ambiguities in particular. Despite the lack of studies specifically addressing children's processing abilities, there are some expectations from the language acquisition literature about how children might employ syntactic, semantic and referential factors during syntactic ambiguity resolution.

In one of the earliest attempts to study children's language processing in real time, Tyler and Marslen-Wilson (1981) examined children's reliance on syntactic, semantic and pragmatic information. Children (ages 5, 7 and 10) performed a word-monitoring task as they listened to either normal speech, semantically anomalous speech, or scrambled (syntactically anomalous) speech. All age groups showed patterns similar to those reported for adults, with the ability to detect a word becoming slower and less accurate as one compared normal speech to semantically anomalous speech to syntactically anomalous speech. This finding suggested that children were developing essentially the same types of analyses of the input as adults, and that the time course of the

construction of these syntactic and interpretative analyses did not differ across ages.

Of most relevance for the current work are experiments that indicate that children have an understanding of the relevant contextual factors associated with the Referential Theory (illustrated earlier in this chapter) and employ this information in their ultimate comprehension of a sentence (e.g., Hamburger and Crain, 1982). In particular, Hamburger and Crain (1982) argued that the general failure of children (age form 4 to 6) to correctly act-out sentences like 'The camel kicked the tiger that bumped the zebra' was not due to a lack of knowledge of the relative clause structure (see Sheldon, 1974; Tavakolian,, 1981) but rather to a failure to satisfy the relevant felicity conditions associated with the use of restrictive modifiers (see also Crain, McKee and Emiliani, 1990). As mentioned above, the use of restrictive modifiers is appropriate if the sentence is uttered when the denotation of the NP contains more than one member. It was shown that when a set of tigers was present (e.g., three toy tigers), children showed a much more accurate understanding of the restrictive relative clause in the act-out task. These studies suggest that children have knowledge of the contextual factors associated with the Principle of Referential Success, and, in keeping with the general notion that this information plays a greater role than syntactic cues, this knowledge guides the understanding of the restrictive relative clause.

In more recent years, there has been a growing body of literature investigating children's sentence processing in real time using on-line techniques that are familiar from adult sentence processing studies, such as cross-modal priming, eye-tracking and event-related brain potentials (Traxler 2002, Booth, MacWhinney and Harasaki 2000, Roberts, Marinis Felser, and Clahsen 2003), (McKee, Nicol and Daniel 1993, Love and Swinney, 1997; Trueswell, Sekerina, Hill and Logrip 1999, Sekerina, Stromswold and Hestvik 2004; Friederici & Hahne 2001).

Two of these studies, Love and Swinney (1997) and Roberts, Marinis, Felser, and Clahsen (2003) examined whether children reactivate a moved constituent at its gap position and how children's more limited working memory affects the way they process filler-gap dependencies. The study draws upon an area of sentence comprehension that has been extensively studied with adults, namely the processing of filler-gap dependencies in sentences such as *Which car*$_i$ *did Mary say John had bought* t_i in which the dislocated constituent *which car* is syntactically linked to its original direct object position. In generative-transformational theories of grammar (Chomsky 1981, 1995), the syntactic link between these two positions is conceived of as a movement chain, with the original position hosting a syntactic gap ('trace'), i.e. a silent copy of the moved element. Antecedent reactivation effects in cross-modal priming experiments have provided a source of evidence indicating that syntactic gaps are part of the

processing of sentence structure, by showing that the moved constituent is mentally reactivated at gap sites. Another important property of filler-gap dependencies is that they impose a burden on the processing resources insofar as the dislocated element must be held in working memory until it can be reconstructed at its original structural position. In fact, antecedent reactivation in filler-gap constructions has been found to be affected by working memory. Antecedent priming in children (age form 4 to 6) has been studied by Love & Swinney (1997). They adopted the cross-modal picture priming task from McKee, Nicol and McDaniel (1993) to investigate object-relative clauses such as (17):

(17)   [The zebra]$_i$ that #1 the hippo had kissed t_i #2 ran away.

Children were given pictures at the two positions indicated in (17). The picture could either be a picture of a related target -- the dislocated direct object NP (e.g. *zebra* in (17)), or a picture of an unrelated target, -- a picture of another animal (e.g. a *camel* for (17)). The results were similar to those found for adults. An antecedent-priming effect was found at the position indicated by #2 in (17), thus showing that children, like adults, were holding the dislocated element in working memory until the occurrence of the gap site, where it is reconstructed.

In a subsequent series of experiments with similar filler-gap syntactic constructions, Roberts, Marinis, Felser, and Clahsen (2003) replicated the result

of Love and Swinney (1997) and also find a statistically significant interaction between the participants' working memory span and antecedent reactivation: High-span children and high-span adults showed evidence of antecedent priming at the gap site, while for the low-span participants, there was no such effect. The antecedent priming effect in the high-span participants indicates that in both children and adults, dislocated arguments access their antecedents at gap positions.

What emerges from these studies is that children from the age of 4 to 6 employ essentially the same parsing mechanisms as adults and that differences between children and adults observed in these experiments can be attributed to other factors such as children's more limited working memory capacity, their reduced lexicon, or slower speed of lexical retrieval relative to adults (see also Booth et al. (2000) for the demonstration of effects of memory span on children's processing of structurally complex sentences). A similar conclusion has been drawn from the results of an eye-tracking study (Sekerina et al. 2004) with 5 to 4 year-old children investigating the processing of reflexive and non-reflexive pronouns. The children's eye movement data were found to be parallel to those of the adults, the only difference being that the children required more time than the adults to access sentence external referents for pronouns.

Overall the results of several experiments on children's processing abilities, some of which reported here, are compatible with a continuity view of

language processing according to which the parser is the same for children and

adults and that any performance difference between children and adults results

from other factors (Crain & Wexler 1999).

Chapter II

2.1 Introduction

In Chapter I, we introduced different models of language processing. One of the

goals of those models is to explain how temporary syntactic ambiguities are

resolved on-line. We have considered the hypothesis proposed by Crain and

Steedman (1985) according to which garden path effects, might be overcome if

the appropriate referential context is used. Several empirical studies have

provided support to this view (Altmann and Steedman, 1988; Altmann, Garnham

and Dennis 1992; Trueswell, Sekerina, Hill and Logrip, 1999; Sedivy, Tanenhaus,

Chambers and Carlson, 1999; Spivey, Tanenhaus, Eberhard and Sedivy 2002;

among the others). One such study, the one conducted by Trueswell et al. (1999),

plays an important role in the present work because it represents one of the first

attempts to compare children's and adults' processing mechanisms. As we have

seen in Chapter I, many studies have found strong similarities in children's and

adults' processing mechanisms. The next step is to investigate if children make

use of contextual information in the same way as adults. The present chapter

describes a series of experiments conducted by Trueswell et al. (1999), both with

children and adults, to evaluate if children and adults share the same processing

mechanisms in resolving temporarily syntactic ambiguities. The findings by

Trueswell et al. (1999) were taken by these authors to show that children might

not be sensitive to features of the referential context to the same extent as adults

are in resolving temporary syntactic ambiguities. The purpose of this chapter is to

reexamine this conclusion, by highlighting one feature of the Trueswell et al.

study which we believe deserves further scrutiny.

2.2   A well investigated ambiguity

A central question in recent studies of on-line sentence processing is whether

children rely on the same parsing strategies as adults in resolving temporary

syntactic ambiguities. In particular, several studies have focused on adults' ability

to resolve ambiguities involving two prepositional phrases (PPs) in sentences like

(1).

(1)   Put the frog on the napkin into the box.

Upon encountering the first PP *on the napkin*, the listener is unsure whether

additional linguistic material will follow. Given the incremental nature of the

parser, which attempts to an interpretation without waiting the end of the

sentence, a temporary ambiguity arises at this point, because the PP *on the napkin*

can either be attached 'high' to the verb, specifying the destination of the action

(i.e., the empty napkin), or it can be attached 'low' to the noun phrase, indicating

which frog to move (i.e., the frog that is on the napkin). Previous research in adult

sentence processing has demonstrated that, in the absence of context, the

psychological parser prefers 'high' attachment, yielding the interpretation in

which *on the napkin* is the destination of the action. Supporting this conclusion is

evidence of telltale signs of garden path effects at the second PP *into the box* (see

Rayner et al., 1983; Ferreira and Clifton, 1986).

Different explanations have been proposed for the source of this

attachment preference outside of context.[11] According to Constraint Satisfaction

models, the preference for VP-attachment is based on the lexical properties of the

linguistic input (i.e., the verb *put*), and the frequency with which particular

syntactic constructions are used. The verb *put* frequently associates the first PP

with the Destination interpretation, so a VP-attachment preference for the

sentences under consideration is predicted (Trueswell and Tanenhaus, 1994). All

structurally-based models attribute the VP-attachment preference to a general

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[11] See Spivey-Knowlton and Sedivy (1995) and Trueswell et al. (1999) for a complete review.

preference towards an argument interpretation, although for different reasons. As we have seen above, the prepositional phrase *on the napkin* could either be attached to the preceding noun phrase *the frog* or it could be attached to the verb *put.* However, only when the PP *on the napkin* is attached to the verb it introduces an argument (or assigns a Theta role) while in case of NP-attachment it is analyzed as an adjunct.

Interestingly for structurally-based models, the argument interpretation gives rise to garden path effects. Some models claim that argument interpretations result in structurally simpler configurations (i.e., Frazier, 1987). Other models assume that the VP-attachment preference follows from a parsing principle that instructs the parser to assign the theta roles associated with a verb as soon as possible, all other things being equal (Gibson, 1991; Gorrell, 1995; Weinberg, 1992, among others). We will consider the relevance of theta role assignment for parsing in the next chapter. For the time being, it suffices to assume, as widely demonstrated, that there is a VP-attachment preference for the first PP in sentences like (1). For the sake of brevity, we will call this tendency VP-attachment Preference.

The garden path effect arises in sentences like (1) as follows. The English verb *put* assigns three theta roles. Among these three theta roles, we will focus on the the Theme role and the Destination role. These theta roles are usually realized by a noun phrase and a prepositional phrase, respectively. The parser assigns the

Theme theta role to the NP *the frog* and, in accordance to the VP-attachment

Preference, it assigns the Destination theta role to the PP *on the napkin*. These

theta roles are assigned before the parser encounters the second PP *into the box*.

Having discharged the theta roles associated with the verb, the subsequent

appearance of the PP *into the box* informs the parser that it has been led down a

garden path. In response, the parser attempts to revise its initial decision to assign

the Destination theta role to the first PP *on the napkin*. The necessary revisions

include a reanalysis of the first PP *on the napkin* as a modifier of the NP *the frog*,

instead of the interpretation dictated by the VP-attachment Preference.

So far, we have been talking about preferences for VP-attachment when

sentences like (1) are presented in absence of a visual context. The effects of the

VP-attachment Preference, however, can also be observed when sentences are

presented in certain referential contexts. One such context is depicted in Figure 1,

where there is one frog on a napkin, a chick, an empty napkin and a box.

Following Tanenhaus et al. (1995), we call this the 1-Referent Context. In

response to the instruction in (1), both children and adults are expected to

experience a garden path in this context, when they encounter the second PP *into

the box* (Tanenhaus et al., 1995).
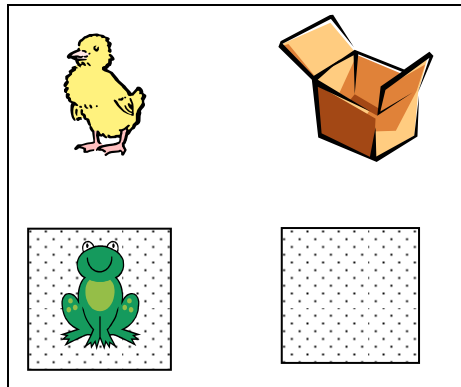
Figure 1: The 1-Referent Context

(1)   Put the frog on the napkin into the box. [12]

In other referential contexts, however, garden path effects are not anticipated. One such context is depicted in Figure 2, where one frog is on a napkin, a second frog is not on a napkin, there is an empty napkin and an empty box. Following Tanenhaus et al. (1995), we call this the 2-Referent Context. In response to the instruction in (1), in the 2-Referent Context, the parser should respond by analyzing the PP *on the napkin* as a modifier.

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[12] The example is open to another interpretation, in which the PP *into the box* is interpreted as a modifier of the preceding NP *the napkin*. This meaning can be paraphrased as "Put the frog on the napkin that is in the box". Although this interpretation may be accessed in certain contexts, it is ruled out in the 1-Referent Context by the Principle of Referential Success, since there is no napkin in the box.
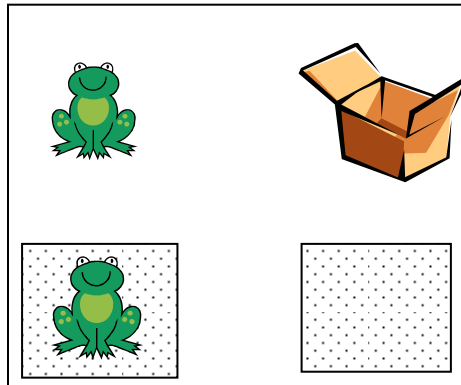
Figure 2: The 2-Referent Context

The elimination of garden path effects in the 2-Referent Context follows from the principles postulated by the Referential Theory. According to the Referential Theory, a parsing principle, the Principle of Referential Success directs the parser to abandon structural analyses that do not successfully refer to entities represented in its current model of the domain of discourse, and to maintain analyses that succeed in referring to entities in the model. In the 2-Referent Context, according to Truesweel et al (1999), which in turn maintains the assumption endorsed by Tanenhaus et al. (1995), the presence of two frogs in the domain of discourse prevents the parser from analyzing the PP *on the napkin* as the destination of the 'putting' event (VP-attachment Preference). This attachment of the PP, in fact, would prevent the parser from successfully identifying the referent of the initial definite NP *the frog* in the discourse. Thus, the Principle of Referential Success preempts the application of the VP-attachment Preference and leads the parser to

attach the PP *on the napkin* as a modifier because, only on this analysis, the parser

succeeds in referring to an entity in the discourse -- namely the frog that is on the

napkin, thus satisfying the presupposition of uniqueness triggered by the definite

NP *the frog*. Once the PP *on the napkin* has been attached 'low,' the parser

assigns the Destination Theta role required by the verb *put* to the PP *into the box*.

On the Referential Theory, no garden path effect is anticipated in the 2-Referent

Context.[13]

2.3   Presenting children with temporary ambiguities in context

In a recent series of studies using a head free eye-tracking system, Trueswell et al.

(1999) examined the parsing strategies used by children and adults in resolving

the attachment ambiguity in sentences like (1), repeated below.

(1)   Put the frog on the napkin into the box.

The experiment used an Act-out task in which subjects were asked to perform the

instruction given by the experimenter relative to a given context. Besides, the

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[13] As we said in Chapter 1, there actually is no agreement as to whether the role of the context is that of facilitating the re-analysis of an interpretation that has proven untenable or that of preventing such an interpretation. Our phrasing assumes the latter scenario, which possibly represents the strongest view of the role of context.

participants' eye movements were monitored as they were asked to respond to instructions while looking at visual displays. The visual displays constitute the context against which the instruction is processed. The instructions consisted of sentences containing the verb *put* followed by two prepositional phrases as in (1). The study considered contexts which supported the VP-preference (the 1-Referent Context) and contexts in which the Principle of Referential Success was expected to forestall the VP-Preference (the 2-Referent Context).

The results from the adult participants are interpreted by the Trueswell et al. (1999) as in accordance with the experimental hypothesis.[14] In the 1-Referent Context, adults showed a preference for VP-attachment of the PP *on the napkin*. Although adults typically performed the correct actions (e.g., moving the frog directly into the box) in the 1-Referent Context, they nevertheless moved their eyes to the 'empty' napkin as they were processing the PP *on the napkin*. The actions and eye-movements by adult subjects in the 1-Referent Context are interpreted by Trueswell et al. (1999) as evidence that adults initially mis-analyzed the PP *on the napkin* as filling the Destination theta role (hence, the glances to the empty napkin), but adults were able to revise their analysis (hence, the correct actions). According to Trueswell et al. (1999), the findings for adults in the 2-Referent Context were consistent with the Referential Theory. Not only did adults perform the correct actions in this context, but they did not move their eyes

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[14] We will offer our own interpretation of the adults' behavior at the end of the chapter.

to the empty napkin. By inference, adults immediately interpreted the first PP *on the napkin* as a modifier of the NP the frog, thereby avoiding even recoverable garden path effects. This pattern of behavior conforms to the predictions of the Referential Theory.

Let us now turn to the responses of the child subjects in the Trueswell et al. study. In the 1-Referent Context, children, as adults, preferred VP-attachment for the PP *on the napkin* consistently with the VP-attachment preference, but children were less able than adults to overcome the garden path effects they experienced. Not only did children look at the empty napkin, as did adults, they also moved the frog onto that napkin, on over half of the trials.[15] We return to a finer grained analysis of children's responses momentarily. It will suffice for now to observe one main difference between children and adults: children are less able than adults to recover from their initial mis-analysis of temporary ambiguities in sentences like (1). This difference is evident from children's behavior alone, without resorting to the recording of children's eye movements.

The difference between children and adults also emerged in the 2-Referent Context. In contrast to adults, children continued to make 'errors' in performance, just as they had in the 1-Referent Context. Children performed 'incorrect' actions on over half of the trials. In particular, children's incorrect actions involved the

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[15] Trueswell et al. (1999) do not report individual responses so we do not know whether all children were equally responsible for the observed non-adult responses or whether the reported percentages derive from a subgroup of children who consistently performed non-adult actions.

'wrong frog' -- the one that was not on the napkin-- on 90% of their non-adult responses. Although children manifested several distinct patterns of non-adult behavior, the overall conclusion would seem to be that children, as often as not, interpreted the PP *on the napkin* as the destination of the putting event, rather than as a modifier of the NP *the frog*. If so, it would seem that, for children, the Principle of Referential Success did not effectively block the VP-attachment Preference.[16] And once again children were unable to revise their initial attachment of the PP *on the napkin* as the destination of the putting event. Again, this can be seen by looking at their actions and there is no need to consider the data from eye movements.

These findings led Trueswell et al. (1999) to two conclusions. First, Trueswell et al. (1999) conclude that children are less able than adults to use the referential context to guide their on-line parsing decisions, at least in certain circumstances. This is how Trueswell et al. (1999; p. 121) put it:

> "Children's initial parsing preferences appeared insensitive to the
>
> Referential Principle. Instead, children preferred the Destination
>
> interpretation of an ambiguous prepositional phrase (VP attachment),

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[16] For the purposes of this paper we focus on the actions performed by children. We refer the reader to Trueswell et al. (1999) for a complete and detailed discussion on the on-line eye-movements patterns. We will offer our own view about the relevance of those data momentarily.

regardless of context."[17]

The second conclusion drawn by Trueswell et al. is that children are unable to retrace their footsteps, once they have been led down a garden path. The same conclusions have been argued for by Hurewitz, Brown-Schmidt, Thorpe, Gleitman and Trueswell (2000).

In a subsequent series of experiments using a 2-referent context kind of scenario, Hurewitz et al. (2000), tried to evaluate the effect of isolating the relevant referent in the 2-Referent Context (i.e., the frog on the napkin) by means of two different manipulations. The first manipulation involved telling a story in order to direct the child's attention on the relevant frog, i.e., the frog on the napkin. In one experiment, children were given the instruction after being told a short story by the experimenter. The story established a difference between the two potential referents (i.e., the two frogs). For example, in one story the frog on the napkin went to visit the house of Mrs. Squid (another toy animal in the story) and then came back were it was before (on the napkin) while the other animal, the frog off the napkin, did not. Children were then asked a question about which was the frog that went to visit the house of Mrs. Squid. Interestingly, answering this

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[17] As suggested by this quote, Trueswell et al. do not conclude that children lack knowledge of the Principle of Referential Success. Rather, their interpretation of the experimental results is that children sometimes fail to employ Principle of Referential Success under certain processing conditions (e.g., when the Principle of Referential Success and the lexical properties of a verb push in opposite directions).

question requires that children notice that the only difference between the two frogs lays in the fact that one frog is on a napkin while the other is not. After the child gave her answer, she was given instruction *Put the frog the napkin into the box*.

The results documented by Hurewitz et al. (2000) showed that even if children were able to use the PP *on the napkin* as a restrictive modifier answering the question, i.e., saying *the frog/the one on the napkin* (72% of all answers) they failed to analyze the same PP as modifier in acting-out the instruction of a sentence like *Put the frog on the napkin into the box*. Children's responses to such sentence mirrored the ones obtained by Trueswell et al. (1999). We now turn to the second manipulation put forth by Hurewitz et al. (2000) in an attempt to direct children's attention on the relevant referent. The idea of this further experiment exploited the possibility that the platforms used in previous experiments, i.e., napkins, were not enough salient or interesting for children thus were gone unnoticed. To overcome this potential problem, Hurewitz et al. (2000) decided to employ more salient objects as platforms: napkins were substituted with colored umbrellas and fancy mirrors. Other than changing the platforms the animals were on, everything was kept the same and the two animals in the scene were discernable by location (i.e, one frog was on a mirror while the other was not). Once again, however, children behaved as in the Trueswell et al. (1999) in performing the wrong action 60% of the time. The conclusions drawn by

Hurewitz et al. (2000) are also similar in spirit to the ones drawn by Trueswell et al. (1999): first, children have difficulties in recognizing referential cues as crucial in reference resolution (thus entertaining the VP-interpretation of the initial PP) and, second children are unable to recover the correct interpretation once led down the garden path.

The focus of this chapter is on the conclusion that children are less sensitive than adults to features of the referential context and that, therefore, their behavior is not governed by the same parsing principles. In what follow, we will argue that the persistence of a preference for VP attachment in the 2-Referent Context cannot be interpreted as a failure to obey the Principle of Referential Success. Given that the studies conducted by Trueswell at al. (1999) and Hurewitz et al. (2000) lead to the same conclusion, from now on we will refer to the set of experiments conducted in the Trueswell et al. (1999), the original study. However, we will refer to the experiments reported by Hurewitz et al. (2002) when our hypotheses will make specific predictions about the manipulations introduced in this study.

2.4   Putting children 'in the right context'

We propose a different account of children's non-adult behavior. We wish to

acknowledge first that we agree with one of the conclusions offered by Trueswell

et al. (1999). The data clearly show that children are less able than adults to revise

their initial interpretation when they are confronted with linguistic input that

cannot be incorporated into the structural analysis they are entertaining. This

difference between children and adults is well documented in the literature as the

source of children's non-adult responses to several linguistic constructions.[18] This

said, we would like to focus on the second conclusion reached by Trueswell et al.

(1999) namely that children's behavior is indicative of a failure to adhere to the

Principle of Referential Success.

Let us have a closer look at the data. First of all, it is important to recall

that not all the children performed non-adult actions in the 2-Referent Context of

the Trueswell et al. experiment. Rather, roughly half of children's responses were

correct. In responding to (1), for example, children sometimes moved the frog

which was already on the napkin into the box. Trueswell et al. conclude that the

vast majority of children resorted to a guessing paradigm in the 2-Referent

Context. According to Trueswell et al., children who produced the right sequence

of actions, in fact, did so for the wrong reason. Their argument goes roughly as

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[18] We will review some of the relevant literature in Chapter V.

follows: 'upon hearing the fragment 'Put the frog…'most children guessed which of the two frogs to select. About half of the time, children made the right guess (though not for the right reason) choosing the frog that was on a napkin. When children heard the remainder of the target sentence on those trials, they were reticent to attach the first PP *on the napkin* to the VP *put* as suggested by the VP-attachment preference, because the frog they had selected (by chance) was already on a napkin. Thus, children ignored the first PP *on the napkin* on these trials, and responded only to the second PP *into the box*. Evidence in favor of this interpretation, according to Trueswell et al. (1999), comes from the analysis of the pattern of fixations of children relative to the 2-referent context. According to Trueswell et al. (1999) children's selection of the referent was in fact partially correlated to which object in the scene children happened to look first. In other words, children performed the correct only if they happened to look at the right object first (the frog already on a napkin); By contrast, they performed the incorrect series of actions if they happened to look at the incorrect referent first (the frog off the napkin).[19] Now, according to Trueswell et al (1999), this correlation in not surprising given that correct actions involved moving the frog on the napkin while incorrect actions involved moving the frog not on the napkin. Thus, those children who were lucky enough to fixate on the right animal ended

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[19] The percentages reported by Trueswell are as follows: when the correct animal was fixated first, it was selected 63% of the time. In addition, when the incorrect animal was fixated first, it was moved 71% of the time.

up performing the right action. According to the authors, evidence of guessing also comes from the fact that even in the correct trials, children continued looking at the empty napkin till a little after the beginning of the second PP *into the box*. This was taken to mean that children were still considering the VP-attachment interpretation of the PP *on the napkin* even after hearing the PP *into the box*, which is the disambiguation PP, has been uttered. We think this observation has to be taken with a grain of salt for different reasons. First, as observed by Trueswell et al. (1999), dividing the data into correct and incorrect trials "resulted in a number of missing cells in subjects and item means, thereby making it difficult to perform adequate statistical test (Trueswell et al. 1999:113)." Thus the correlation in question might be less significant than what claimed. Second, although the data reported by Hurewitz (2000) for the correct trials could be used to support the correlation between early looks and action performed, (but we will see soon a criticism of this), the data relative to the incorrect trials do not. The data from the incorrect trials in the Hurewitz et al. (1999) study show an equal proportions of early looks to the correct and the incorrect object. A further concern about interpreting children's early looks as predictors of children's later actions has to do with the claim that incorrect actions tend to involve movements of the incorrect animal (Trueswell et. al 1999:115). This correspondence is only partially true. In fact, an incorrect action could also regard the correct object. In the case at hand, for example, children could have chosen the frog on the napkin

and moved it to the other napkin: if children have chosen that frog simply by guessing, nothing would have prevented them to perform this incorrect action. We will return on this observation soon. As a final remark, we would like to mention that both in correct and incorrect trials a selection of the object to move didn't occur without a close competition between the two possible objects in the scene. Despite early looks towards on object or the other, children did considered both of them, looking back and forth, until at least the end of the PP on the *napkin*.[20, 21] To end this brief deviation on eye-movements data, we conclude that although, eye-tracking data could provide interesting insights about sentence processing, we think that the recording of the eye-movements do not add anything to the pattern that emerges form children's actions. In the remainder of the chapter, we will thus focus on subject's actions more than on their fixations patters. If anything, the eye data reported by Trueswell et al. (1999) will be also compatible with a different interpretation of the findings, which leads us to the next topic.

We think another explanation of children's adult responses is possible. In our view, the null hypothesis is that children's adult responses should be

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[20] Given the data reported by Trueswell et al. (1999), it is not possible to establish the specific point in which an object has been chosen for the incorrect trials. In fact, since incorrect trials include different kind of actions, some of which involving both frogs, later looks at that correct object are expected.

[21] The fact that it took children considerably longer to select a referent for the definite NP has been used by Trueswell et al. (1999) as evidence of children's difficulty in using the referential context to disambiguate the sentence in favor of the NP-attachment of the PP *on the napkin*. However, as we will see in a moment it is compatible with yet another explanation according to which both NP-attachment and VP-attachment can be used to identify the referent. Such a delay in setting on an object is thus expected.

explained by drawing upon the same principles that account for adult responses. Furthermore, the data suggest that it would be misleading to abandon this position. To see this, we need to look at children's responses in the 2-Referent Context, as compared to the 1-Referent Context. First, whenever children selected the right frog in the 2-Referent Context – the one on the napkin -- they performed an incorrect sequence of actions just 10% of the time. The question is why these children did not misinterpret the following PP as destination of the VP *put*. As we have seen, Trueswell et al. argue that children who guessed right in the 2-Referent Context ignored the PP *on the napkin*, because the frog they had selected (by chance) was already on a napkin.

Although this sounds plausible, there is some evidence against it. If it were true, then children could have made the same inference in the 1-Referent Context. Recall that in that context, there was a single frog, which was on a napkin, as well as an empty napkin. By parity of reasoning, the child subjects should have ignored the PP *on the napkin* in the 1-Referent Context just as often as the child subjects did in the 2-Referent Context, putting the only frog directly into the box, rather than on the empty napkin, on the grounds that it was already on a napkin. However, children moved the frog (from the napkin it was on) to the 'empty' napkin on 56% of the trials in the 1-Referent Context. To summarize, whenever children selected the right frog in the 2-Referent Context – the one that was on the napkin -- they produced 'incorrect' responses 10% of the time, by contrast

whenever children selected the only frog in the 1-Referent Context they produced incorrect responses 56% of the time. Clearly, this is a significant difference in behavior, which casts doubt on the proposal by Trueswell et al. that children who performed the right action ignored the PP *on the napkin* in the 2-Referent Context. For this reason, we will maintain the assumption that children who performed the right actions did so for the right reasons in the 2-Referent Context. This said, we now examine the behavior of children who did not perform the right action.

Let us now examine the pattern of children's non-adult actions in the 2-Referent Context. There were three patterns of non-adult behavior, all involving the frog that was not on a napkin. First, children sometimes moved the frog that was not on a napkin onto the empty napkin without performing any further action. In other words, they ignored the content of the second PP *into the box*. Trueswell et al. (1999) call this error 'falling short.' Second, children sometimes moved the frog onto the empty napkin and then into the box. Trueswell et al. (1999) call this error 'hopping' Third, children sometimes performed two separate actions: first they moved the frog that was not on the napkin onto the empty napkin, and then they moved the frog that was initially on a napkin into the box. Trueswell et al. (1999) call this error 'one of each.'

The critical observation is that children who performed an incorrect action chose the wrong frog – the one that was not on a napkin 90% of the trials. Contrary to what one might think at first sight, this response is not so naïve. In

fact, nothing in the context prevented children from making other mistakes, i.e., moving the right frog - the one that is already on the napkin - onto the empty napkin. [22]We contend that, in the 2-Referent Context, children's non-adult responses were due to a pragmatic inference and that the pragmatic inference was made in an attempt to individuate a uniquely salient frog, in compliance with the Principle of Referential Success.

As we saw earlier, the main assumption underlying Trueswell et al. study is that garden path effect in the 2-Referent Context would denote insensitivity to the Principle of Referential Success. Moreover, Trueswell et al. (1999) mention only one scenario under which the presupposition of uniqueness associated with the use of the definite article *the* in *Put the frog…* could be satisfied in the 2-Referent Context; this amounts to analyzing the PP *on the napkin* as the modifier of the preceding NP *the frog*. This is how Trueswell et al. (1999; p. 96) put it:

"In this case, upon hearing "the frog," a listener would not know which frog is being referred to, and should thus interpret the phrase 'on the napkin," as a Modifier."

[22] Proof of the fact that children could have moved the frog from the napkin it was on to the empty napkin comes from the fact that they often performed that kind of action in the 1-Referent Context.

In our view, this assumption is unwarranted. In fact, NP-attachment is not the only scenario under which the listener would know which frog should be moved. Under a VP-attachment scenario a simple pragmatic inference would also allow the listener to select a uniquely salient frog that should be moved.

To introduce our critique, let us consider the Trueswell et al. scenario in more detail. The occurrence of the definite determiner *the* is crucial for the successful interpretation of the sentence. However, one could observe that besides the NP *the frog*, the definite determiner occurs in other positions in the sentence. In particular, we would like to focus on the NP *the napkin* which is part of the first PP. Even more interesting, is the observation that the experimental workspace, both in the 1-Referent and the 2-Referent Context, contains two identical napkins. This means that, if we follow the same logic entertained by Trueswell et al., upon hearing the fragment *on the napkin* children (as well as anybody adhering to the Principle of Referential Success) should be confused about which is the intended napkin to the same extent as they are in identifying the intended frog since no linguistic material can be used to identify a uniquely salient napkin. However, the results tell a different story. Children (and adults) do not experience any difficulties in identifying the relevant napkin: they always chose the empty napkin as the destination. The question is why children who apparently experience difficulty in identifying the intended frog do not experience any difficulty in identifying the intended napkin. Our proposal is that children

performed a pragmatic inference. The argument goes like this. As children hear the fragment *Put the frog on the napkin…* they know they have to move the frog on a napkin. Now, there are two napkins available but, since one of the napkins is already taken by another frog, they think the empty napkin is the intended one.

If this reasoning is on the right track, Trueswell et al. must assume that children (and adults) make a reasonable pragmatic inference as to which napkin is the intended napkin. In doing this, they obey to the Principle of Referential Success according to which the interpretation that violates less presuppositions has to be chosen. Remarkably, if, as we just showed, children carried out a pragmatic inference in order to single out the intended napkin, one might wonder why children could not follow the same line of reasoning to identify the intended frog. Recall that, according to Trueswell et al., the only factor in the 2-referent context, which should lead children (and adults) to interpret the PP *on the napkin* as a modifier of the preceding NP *the frog* thus avoiding the garden path effect, is constituted by the presence of two identical frogs. As we have seen, however, children were able to use cues from the referential context to disentangle themselves from the infelicity of hearing the definite NP *the napkin* in presence of multiple napkins. With this in mind, we must consider the possibility that, contra Trueswell et al, interpreting the PP *on the napkin* as a modifier of the noun phrase *the frog* is not the only way to identify a unique entity in the discourse prior to hearing the disambiguating PP *into the box*. Another logical possibility would be,

in fact, to perform a pragmatic inference which could be triggered by the Principle of Referential Success. The story is simple. As children heard the sentence fragment *Put the frog on the napkin*…. they (implicitly) reasoned as follows: "The experimenter is asking me to put the frog on the napkin… But there are two frogs. Which one is she referring to? I know…, the one that is not already on a napkin." Under this view, children were making a reasonable pragmatic inference that the experimenter's intended referent for the NP *the frog* was clearly discernable in the context – it was the frog that was <u>not</u> already on a napkin. This pragmatic inference is carried out by children in accordance with the Principle of Referential Success which, in the case at hand, demands the identification of a unique frog. It is crucial to notice that this inference is possible only if the PP *on the napkin* is interpreted as a destination. Thus, children are <u>expected</u> to experience a garden-path when the second PP *into the box* occurs since another PP has received the destination Theta role. In sum, the application of a pragmatic inference together with children's inability to revise their initial interpretation explains children's non-adult actions.

Let us consider the consequences of this hypothesis for the Trueswell et al. study. That study was based on the assumption that a garden path effect would be a sign of a failure to adhere to the Principle of Referential Success. However, as described above, it is possible that a garden path effect would follow from the <u>adherence</u> to the Principle of Referential Success.

In our view, the experimental findings reported by Trueswell et al. do not support the conclusion that children are less sensitive than adults to contextual factors in the resolution of ambiguities. In particular, we would like to contend that one of the contexts used in the Trueswell et al. experiment, the 2–Referent Context, might not constitute an appropriate context to evaluate children's (or adults') adherence to the Principle of Referential Success. As we have seen, in fact, children might have found another way to identify a unique frog in the 2-Referent Context without resorting to the NP-attachment of the PP *on the napkin*—namely by performing a pragmatic inference which would ultimately lead them to choose the frog not on a napkin. If this is the case, the Principle of Referential Success could be satisfied either by VP-attachment or NP-attachment of the PP *on the napkin* in the 2-Referent Context. Moreover, children would show sensitivity to referential cues provided by the context as well as ability to perform pragmatic inferences. But we are only half way home. It remains to substantiate the hypothesis that children who selected the wrong frog (the one not on a napkin) did so because of a pragmatic inference. This is the topic of next chapter.

Before we do that, however, we should explain why adults do not seem to experience problems in the 2-Referent Context. In fact, if we are assuming that the context is compatible with both NP-attachment and VP-attachment of the first PP *on the napkin*, this should exert an effect also on adults. Let us recall, that

adults commit very few mistakes in acting-out the given instruction in the 2-Referent Context as well as in the 1-Referent Context, the context in which a garden-path at the occurrence of the second PP *into the box* is expected. This means that adults' actions cannot be used to evaluate the effect of the referential context in resolving a temporary ambiguity occurring with the verb *put* followed by two PPs. The relevant evidence comes from the eye movement data reported by Trueswell et al., however. In particular, at the occurrence of the PP *on the napkin*, the analysis of adults' eye movements show increased looked towards the empty napkin in the 1-Referent Context but not in the 2-Referent Context. This was taken by Trueswell et al. (1999) to mean that adults did not consider the empty napkin as a possible destination in the 2-Referent Context, thus they were not entertaining the VP-attachment of the PP *on the napkin*. In other words, adults were using contextual information, i.e., the fact that two identical frogs were present, early in the process of interpreting the sentence. However, we think that before drawing any conclusion about adults we should consider other factors that might have played a role. First of all, one has to take into consideration the fact that adults are generally better than children at taking tasks. Adults know they are being tested and often try to devise strategies to comply with the experimenter's requests. In the case at hand, an act-out task relative to a simple visual display, one might wonder if adults might have 'learned' not to be mislead by the sentences along the way, for example by waiting till most of the information has

been uttered. In support of this hypothesis, we can offer two observations. First, the few errors in performance observed in adult's behavior come from the first trial (trials) of the whole experiment[23]. This result is not surprising under the reasonable assumption that adults can be tricked (and thus commit mistakes) if caught off guard. However, adults are quick in realizing that they have been tricked and, as a consequence, in the following trials they develop a strategy in order to avoid committing the same mistake twice. One such strategy, as observed above, could have been for example the one to wait until enough information was provided. This strategy is likely to have been adopted by adults in the present experiment given that all the target sentences used involved the verb *put* followed by two prepositional phrases. To make things even more conspiring towards this possibility, the filler sentences used with adults involved the use of complex prepositional phrases such as *Put the frog in between the napkin and the box*. Sentences of that type necessarily lead the listener to wait till almost the end of the sentence before committing to any interpretation[24]. Indeed, and this is the second observation, the data show that adults did not converge on their final decision about which frog was the intended referent for the NP *the frog* till very late. Initially, the eye-movement data show, adults moved back and forth between the two frogs and then the longest time was spent on the frog not on the napkin. If

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[23] Trueswell's personal communication to Stephen Crain.
[24] Filler sentences used with children were much simpler such as *Put the frog here*, now *Put it back and so on*.

the time spent on the frog not on the napkin could be interpreted as meaning that adults were considering that frog a better possible referent for the NP *the frog* in a sentence like *Put the frog on the…,* unfortunately we cannot say base on the data provided by Trueswell et al. (1999, but see also Tanenhaus et al. 1995 and Spivey, 2002).[25] What we can say, however, is that in order to understand how adults process sentences like *Put the frog on the napkin into the box,* an analysis of the first trial of the whole experiment with adults must be performed for each subject. Our prediction is that the eye- movement data for that trial would be very similar to the ones reported for children. As preliminary evidence, we conducted an act-out task with 6 adults (mean age:….). Subjects were asked to act-out as soon as possible the sentence *Put the frog on the napkin into the box* relative to the 2-Referent Context and they were tested on a singe trial. Out of 6 response actions performed by adults, 5 were incorrect. In particular 4 of the incorrect series were 'hopping errors' in Trueswell et al. (1999) terminology. As for the fifth mistake we recorded, the subject selected the frog off the napkin ready to put it on the empty napkin. Then, he stopped with the frog in his hand at the occurrence of the second PP *into the box;* when he realized he had chosen the wrong. Again, this is

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[25] Incidentally, it is worth mentioning that eye movement data consistent with a garden path in the 2-referent context were reported by Spivey et al. (2002). The authors of that study argue against this interpretation of the data on the basis of a third condition (including three frogs off the napkin). We will elaborate on our own explanation as to why a garden path is expected in the 2-Referent Context in the next chapter. For the time-being, we can only say that according to our proposal the difference between the 2-referent context and the Several Frogs-Referent Context documented by Spivey et al. (2002) will turn out to be irrelevant in order to rule out the possibility that a garden path actually occurs in the 2-Referent Context.

a 'mistake' that children in the Trueswell et al. study also produced.

To conclude, although further examination is needed before drawing any conclusion, it seems reasonable to assume that children and adults are not so different after all. Adults are just better test-takers and are able to wait till they have all the relevant information before committing to an interpretation after being misled once. Children do not wait. Adults, as children, know that either frog in the 2-referent context could serve as referent for the NP *the frog*. Adults' selection of the relevant frog is not resolved until very late in the sentence and, even more telling is the observation that the wrong frog (the frog off the napkin) is considered for a longer time than the right frog (the frog on the napkin) early on. As we briefly mentioned in the previous section, both children's and adults' behavior is expected under the assumption that in the 2-Referent Context the computation of a pragmatic inference allows the listener to individuate the referent for the NP *the frog* without recurring to NP attachment. This leads us to the next chapter.

Chapter III

3.1   Introduction

Chapter II introduced the study by Trueswell et al. (1999), which was designed to

assess children's sensitivity to the referential context in processing sentences that

contain a local ambiguity. Our main observation was that the relevant context

employed by Trueswell et al. - the 2-Referent Context - was probably not the

most appropriate experimental context if the goal was to evaluate children's (or

adults') sensitivity to the Principle of Referential Success. Briefly, we argued that,

contra Trueswell et al., in the 2-Referent Context children were probably able to

identify the experimenter's intended referent for the NP *the frog* for the relevant

fragment of sentences like *Put the frog on the napkin into the box*, while

entertaining the VP-attachment interpretation of the PP *on the napkin.* In

particular, given that only one of the two frogs in the context was on a napkin,

children were invited to make a pragmatic inference that the intended referent for

the NP *the frog* (to put on the napkin) was the frog which was not already on a

napkin. In order to evaluate whether this hypothesis is on the right track, we conducted an Act-Out task.

3.2 'On' or 'Off' the napkin

In this section we put to test our claim that children in the Trueswell et al. study were carrying out a pragmatic inference in order to identify the intended referent of the definite NP *the frog* in the 2-Referent Context. As noted in the previous paragraph, when children made incorrect responses in the 2-Referent Context, they chose the wrong frog 90% of the time. We hypothesized that children's non-adult behavior was due to a pragmatic inference they made, which did not violate the Principle of Referential Success. The pragmatic inference enabled children to identify a uniquely salient referent for the NP *the frog* in the experimental workspace. Upon hearing the fragment *Put the frog on the napkin…* children inferred that the unique referent of the NP *the frog* was the one that was not already on a napkin. In the next section, we present an experiment designed to evaluate this hypothesis.

3.2.1. Experiment I

This experiment used contexts like the one depicted in Figure 1 below, which

includes two frogs. One frog is on a napkin, the other frog is not. In addition,

there is an empty napkin in the experimental workspace. We call this the on/off

Context because the two frogs can be distinguished in virtue of being *on* or *off* a

napkin. There is no other object in the picture (i.e., no box, as compared to the 2-

Referent Context of the Trueswell et al. study) because the presence of another

object is irrelevant for the purpose of the present experiment. The reason is

simple: we want to evaluate if children could identify which frog should be

moved when entertaining the destination interpretation of the PP, the only

possible interpretation in the case at end. In fact, if, as claimed by Trueswell et al.,

the presence of two identical frogs in the 2-Referent Context should prevent

children from successfully identifying the referent of the NP *the frog* upon

hearing it, (thus triggering the modifier interpretation of the first PP *on the*

napkin), children should be confused as to which frog is the intended referent in

the on/off Context (where NP-attachments of the PP is not an option). By contrast

if, as we suggested, children are nevertheless capable of singling out a unique

frog, by means of the pragmatic inference described above, they should not be

confused. More precisely, our experimental hypothesis is that, in response to (1),

children's predominant response would be to move the frog that is not already on a napkin and to put it on the empty napkin.
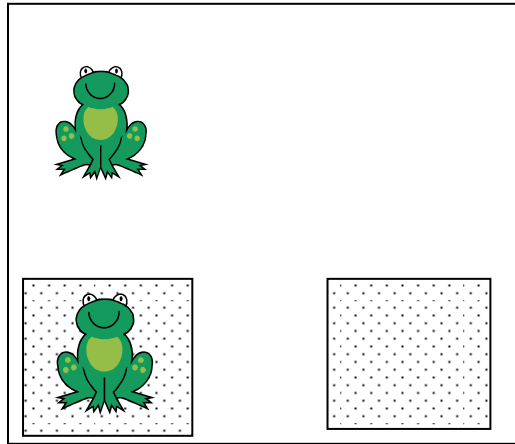
Figure 1: The on/off Context

Children were presented with contexts similar to the one depicted in Figure 1 and were given instructions like (1).

(1)   Put the frog on the napkin.

Fifteen children participated in the experiment. They ranged in age from 3;10 to 5;9, (mean age: 4;7). In this experiment, children were told that Kermit the Frog, a

puppet manipulated by one of the experimenters, had a special project and needed the child's help. Then, while the puppet was entertaining the child, the other experimenter arranged the toys in the experimental workspace (as illustrated in Figure 1). Before each trial, the experimenter ensured that the child knew the names of each object. If the child had a non-standard name for an object, the name offered by the child was used by the experimenter thereafter in referring to the object. By no means did the experimenter's description of the characters biased children towards believing that one of the object was misplaced and needed to be moved somewhere else in the context. Children were tested using an *act-out* task. In this task, the experimenter instructed the child subject to act out ("Do what we say") a sentence using the toys available in the experimental workspace. Each child was presented with four target trials, four fillers and one warm-up. All and only the target trials were instructions containing the verb *put* as illustrated in (1).

As predicted, children moved the frog that was not already on a napkin and put it on the empty napkin 92% of the time (44 out of 48 trials). It is worth noting that children *never* asked the experimenter *which frog?* they should move. Moreover, when they were asked, at the very last trial, to explain why they had moved the frog not on a napkin, they consistently answered "because that one was already on a napkin." We interpret the findings as confirming our hypothesis that children could make a pragmatic inference in the 2-Referent Context in the

Trueswell et al. study, in order to single out a salient frog, as dictated by the Principle of Referential Success. Crucially, this pragmatic inference takes place when the PP *on the napkin* is attached to the VP; the scenario that would create a garden path effect in a sentence like *Put the frog on the napkin into the box*. This means that one cannot use the occurrence of a garden-path effect to conclude that the Principle of Referential Success has not been adhered to.

To sum up, last chapter described an experiment conducted by Trueswell et al. (1999) in order to evaluate children's sensitivity to referential cues in resolving temporary syntactic ambiguities in sentences like *Put the frog on the napkin into the box*. The findings from that study led the authors to conclude that children are not as sensitive as adults to the referential context. After a scrutiny of the data reported, we highlighted a potential problem with the context of the main experiment, the 2-Referent Context. According to the authors, the 2-Referent Context, by virtue of containing two frogs, supports the interpretation of the PP *on the napkin* as modifier of the noun phrase *the frog*, this being the only way to identify the referent of the NP *the frog*. We noticed, however, that in the 2-Referent Context, there is no need to appeal to a modifier interpretation in order to identify one salient frog, despite the presence of two frogs. The same goal could be achieved under the VP-attachment scenario by performing a pragmatic inference, which would ultimately lead children to select the frog that is not on the napkin. An experiment showing that this is possible has been reported. As a

consequence, given that a pragmatic inference could be responsible in part for children's non-adult behavior, the Principle of Referential Success is not at issue. It follows that in order to draw conclusions on children' observance of the Principle of Referential Success, a different context should be employed –namely one for which a pragmatic inference won't be as readily available. Finding such a context is the main goal of the present chapter. In order to do this, we first need to study in more detail the nature of the pragmatic inference we are appealing to.

3.3 A felicitous command

The pragmatic inference under consideration in the present chapter is related to the conversational setting, namely conversations in which children respond to someone's verbal instructions to perform certain actions. In particular, this kind of conversational setting was employed in the Trueswell at al. (1999) study, and in our Experiment I. The proposal here is that the nature of this task can, in part, explain children's willingness to compute a pragmatic inference.

As noted earlier, in an act-out task the experimenter asks the child to perform an action by means of a command or request. In general, it is assumed that every time a sentence is uttered there are some conditions that must be

satisfied in order for the sentence to be 'situational appropriate.' These conditions may be called felicity conditions. Felicity conditions dictate the circumstances in which it is appropriate to ask questions, give commands, and so forth. Before we discuss the felicity conditions associated with commands, it is useful to consider different conversational settings.

Many linguistic constructions have been argued to be associated with felicity conditions. A relevant example is (the use of) negative sentences. As observed by Wason (1972), a sentence containing negation is felicitous, and therefore it is easier to process, if it is used to refute an expectation that has been established in the prior discourse context (see Horn 1989, Ch. 3 for a review). For example, sentence (2) is felicitous if presented after (3), as in (4):

(2)   1 is not an even number.

(3)   2 is an even number.

(4)   2 is an even number. <u>1 is not an even number</u>

It was argued by Stalnaker (1999) that even positive assertions are associated with felicity conditions in conversational exchanges. Stalnaker (1999, p.78) states that "assertions affect, and are intended to affect the context." The context at issue is

the conversational or discourse context. According to Stalnaker (1999) assertive propositions can be uttered felicitously only if the message they convey is not part of the common ground (context set) at the time of the utterance, since assertive propositions are intended to add to the common ground as the conversation progresses[26]. As the conversation progresses, new propositions are added to the common ground. So at each stage during a conversation, the common ground contains a set of coherent and connected propositions. Among the principles that regulate the interaction of assertions and the common ground, Stalnaker (1999; p.88) introduces the principle in (5):

(5)   A proposition asserted is always true in some but not all of the possible
        worlds in the context set.

As (5) makes clear, a speaker is not expected to assert a proposition that is already part of the common ground (i.e., true in all possible worlds of the context set). If a speaker violates this rule, he has done "something that, from the point of view of the conversation, was unreasonable, inefficient, disorderly, or uncooperative" (Stalnaker, 1999; p.89).

The appropriate use of questions is also associated with some felicity conditions. We could see a question as an attempt by the speaker to enrich the set

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[26] For Stalnaker the *common ground* is the set of beliefs or assumptions shared by the participants engaged in a conversation (see also Heim, 1982).

of propositions in the common ground. Therefore, a question is "unreasonable, inefficient, disorderly, uncooperative," if its answer is already contained in the common ground. In particular, if someone asks a question, it is reasonable to assume that (a) he does not know the answer to that question, (b) he wants to know the answer to the question and (c) he thinks the hearer is able to provide such answer.

Going back to commands, here is a general set of felicity conditions that must be satisfied (Austin, 1962):

(6)   **S requests H to do A (action)**

a.   Speaker believes that A has not yet been done.

b.   Speaker believes that Hearer is able to do A.

c.   Speaker believes that the hearer is willing to do A-type things

d.   S wants A to be done.

We focus on the first condition (6)a listed above. Crucially, for our purposes, it follows from (6)a that a cooperative speaker will utter a command only if the state of affairs described by the command does not hold at the time of the command. From the point of view of the hearer, when a command is given, the hearer will make any reasonable inference that will allow him to regard the speaker as being cooperative. In particular, the hearer will attempt to interpret the command such

that the state of affairs that will hold after the command has been executed does not yet hold.

3.4 Commands and Uniqueness

The previous section introduced the notion of 'felicity condition' and provided examples of linguistic constructions whose appropriate use depends on the satisfaction of some felicity conditions. In particular, our interest resides on the felicity conditions associated with requests/commands, since the task children had to carry out in the studies under consideration required them to comply with a request to perform a certain action. There is indeed something peculiar about commands. The relevant intuition is that the felicity conditions imposed by a command lead can sometimes led to a consistent and specific interpretation of an otherwise vague or unspecified expression. To clarify this, consider the following example from Lyons (1999; p.14):

(7)   *Context: in a room with three doors, one of which is open*
       Close **the door**, please.

The sentence in (7) is perfectly fine despite there being three doors in the

conversational context. The intended referent for the NP *the door* is easily

identified: it is the open door. Given the nature of commands, the listener infers

that he is expected to perform an action whose ultimate goal is to make the state

of affairs described by the command – which presently does not hold – to be

instantiated. The listener also infers that the speaker believes he, the listener, is in

a position to perform such an action. Since one can only close a door that is not

yet closed, the listener infers that the intended referent for the NP *the door* is the

only door which is not closed. Once again, the contrast between the state of affairs

requested by the command and the state of affairs which holds when the

command is uttered helps the listener in identifying the referent for the definite

determiner. In fact, despite the presence of multiple doors, one can reasonably

claim that only one door serves as the referent for the NP *the door*. In other

words, the listener can identify the referent of the definite NP in a way that

satisfies the presupposition of uniqueness associated with the use of a definite

determiner. Support for this idea comes from the fact that the acceptability of (7)

actually decreases if the definite NP is replaced by an indefinite NP as in (8), in

the same context.

(8)   Close **a door**, please

The difference in acceptability between (8) and (7) can be explained if we assume

that 'a uniquely (salient)' door is indeed identified in the context under discussion. Thus, the use of the indefinite article, which does not presuppose the existence of a unique referent, is not felicitous.[27]

So far, we have shown that commands can lead to the satisfaction of the presupposition of uniqueness by means of a pragmatic inference ultimately motivated by the desire to obey a command. However, in the example examined so far another explanation is available. It could be supposed that the form of the linguistic construction is irrelevant and that the presupposition of uniqueness is somehow met just because there is exactly one door in the context that can be singled out among the set of doors - in virtue of being open. On this view, the fact that one door in the context has a unique property - the property of being open - which is not shared by the other doors, serves to satisfy the uniqueness presupposition of the definite determiner, not the felicity conditions associated with a command. To adjudicate between the two explanations, consider the sentence in (9):

(9)   The door is open/not closed.

Sentence (9) is an assertion which contains the definite NP *the door* as did example (7). Furthermore, the property predicated of the definite NP *the door* is

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[27] The infelicity follows from a failure to obey the Principle of Maximize Presuppositions that we will introduce in Chapter V.

the one used in (7), the property of being open, and again this property
distinguishes one door from the other doors in the context under consideration.
However, notice that (9) is less acceptable than (7) in the context, despite the
presence of a unique door that has the property predicated in the assertion. To
convey the same meaning, a speaker would probably use an existential
construction, as in (10), or an indefinite NP, as in (11):

(10)   There's a door open.

(11)   One/a door is open.

Given the facts illustrated above, we will assume that the felicity conditions
associated with commands can be used to select the referent of a definite NP.[28] We
have established that it is a prerequisite for commands that the state of affairs
described by the predicate is not yet true of the denotation of the relevant NP. If
there is only one entity in the context for which the command could be
felicitously uttered, then that entity becomes the referent of the definite NP. What
is important is not the mere presence of a unique entity in the context to serve as a
referent for the NP, rather it is the fact that there should be a unique entity that

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[28] Commands are not the only speech acts that can trigger the kind of pragmatic inference under
consideration. A similar effect is obtained with sentences like *I wish the door was closed*, *I am
glad the door is open* etc.

could serve as a referent for the NP <u>and</u> for which the command could be felicitously uttered. In the case under consideration, it does not matter if there is more than one door in the context (i.e., more than one referent for the NP *the door*), what matters is that the command could apply felicitously to only one entity, namely someone could only close a door if that door is not already closed.

A command demands a contrast between the state of affairs that has to be achieved and the state of affair which already holds. This contrast is what motivates the pragmatic inference. This said, one could interpret the command in (7) here reported as (12), as in (13).

(12)   Close the door.

(13)   Close the door [that is not closed yet]

Put it another way, a simple assertion like the one in (9), here reported as (14), does not highlight the contrast between the present state of affairs and the future (possible) one, simply because no action is required: the main goal of (14), is in fact to attribute a property to the entity denoted by the NP. As a consequence, interpreting (14) in analogy with (13) gives rise to a tautology, as shown in (15):

(14)   The door is open/not closed.

(15)   The door [that is open/not closed] is open/not closed

The contrast between what the speaker wants to achieve by means of the command itself and what holds prior to the utterance of the command is what makes the use of a definite NP possible, and maybe even felicitous. However, not all the predicates establish an 'evident' contrast so straightforwardly as the predicate *closed*. A command like *Close the door* can be uttered out of the blue in a room with only one open door (among several doors), because the contrast between what is closed and what is open, is observable in the context. In other words, no previous mentioning of 'that door' is necessary for the listener to identify the intended referent of *the door*. The same, however, does not hold for other kind of predicates that require more interpretative effort on the part of the listener.

(16)   *Context:[three papers which have been read – one paper which has not been read]*
       Read the paper.

(17)   *Context: [three kittens which have been touched– one kitty which has not been touched]*

Touch the kitten.

(18)   *Context: [a room with three heaters that have been felt – one heater which*
        has not been felt]
        Feel the heater

The predicates contained in sentences (16)-(18) all express properties that are less
clearly observable than the property of being closed. It is hard to think of
observable signs which could mark a paper as read, a kitten as touched or a heater
as felt. Furthermore, even if one knew which paper was read, which kitty was
touched and which heater was felt, nothing would prevent the listener from
assuming that the relevant action can be repeated with the same object. As a
consequence, the use of a definite NP with these predicates would be more
problematic from the point of view of the listener. Commands like (16) through
(18) are infelicitous if uttered out of the blue, without prior discussion of the
entity referred to by the definite NP. Although the predicates used in commands
like (16) - (18) set up a contrast between entities in the context that have the
property expressed by the predicate and entities that do not have that property
(yet), this contrast is not directly observable. Thus, any pragmatic inference that
ultimately relies upon the contrast described above is unlikely to be made.

To sum up, we have focused our attention on the felicity conditions associated with commands. We have also highlighted that, because of the felicity conditions associated with commands, a definite NP could be used in a command even if the presupposition of uniqueness is not satisfied in the context. In fact, as we illustrated, the contrast implicit in commands between what has to be achieved in response to of the command itself and what holds when the command is uttered, is a cue that can be used to identify the intended referent for the definite NP. This ultimately is what makes it possible to carry out a particular pragmatic inference. Let us now illustrate how this line of reasoning could be applied to sentences like (19), which are the focus of the present study. In the experiment we presented in section 4.2, children were given the instruction in (19) relative to the On/off Context (Figure 2):
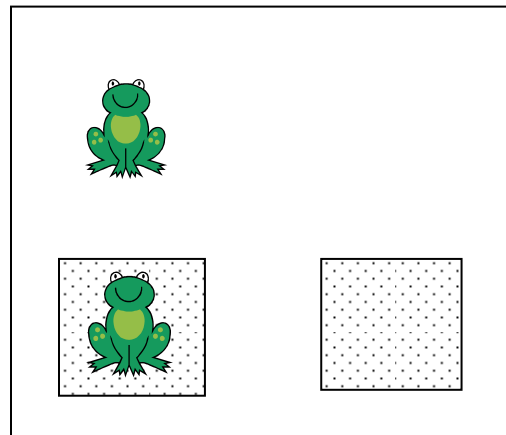
Figure 2: the On/off Context

(19)   Put the frog on the napkin

Spelling out the felicity conditions associated with the request in (19) (from the
point of view of the child subject) yields something like the following:

(20)   **Child: The request is for me to 'Put the frog on the napkin'**

    a.   the state of affairs described by the fragment 'the frog (is) on the

        napkin,' must not yet hold

    b.   the speaker believes I can perform the requested action.

    c.   the speaker wants me to do it.

The pertinent point is (20)a. After incorporating the presupposition of uniqueness
triggered by the use of the definite article, this condition directs the child to
execute an action such that, only after the child's action is performed, 'the
(uniquely salient) frog is on the (uniquely salient) napkin' (which frog and which
napkin to act upon remains to be determined). It is crucial for condition (20)a that
the state of affairs in which 'the (uniquely salient) frog is on the (uniquely salient)
napkin' does not yet hold.[29] In addition, the verb *put together* with the preposition

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[29] As we illustrated in Chapter II, the choice of a uniquely salient napkin is not as trivial as one
might think, given the presence of two identical napkins in the context. Another pragmatic
inference has to be assumed, in fact, for deciding which the intended referent for the NP *the*

on behaves as the verb *close* in that the contrast between what has been put on something and what has not is evident in the context. It does not matter if there is more than one frog in the context, what matters is that the command could apply felicitously to only one frog, namely the one that has not been put on a napkin yet. Given this assumption, the command would be infelicitous if the speaker intended the frog that is already on a napkin to be moved.. This explains why, as we saw, children inferred that *the frog* to be moved on the napkin was *the frog that was not already on a napkin* despite the presence of two identical frogs in Experiment I and in the Trueswell et al. study.

Let us now examine the pragmatic inference that we are proposing in more detail. We have suggested that in Experiment I and in the 2-Referent Context of the Trueswell et al. experiment, children found a way to identify the speaker's intended referent for the definite NP *the frog*, despite the presence of two frogs. Evidently, children inferred that the frog to be moved was the one not already on a napkin. However, as we pointed out previously, another inference had to be made in the 2-Referent Context (as well as in the On/off Context of our experiment): a uniquely salient napkin also had to be identified despite the presence of two identical napkins in the experimental setting.

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napkin is. This gives rise to a complication about the order in which the two pragmatic inferences, each of them relative to each definite determiner in the sentence are carried over. We will address this issue later in this chapter.
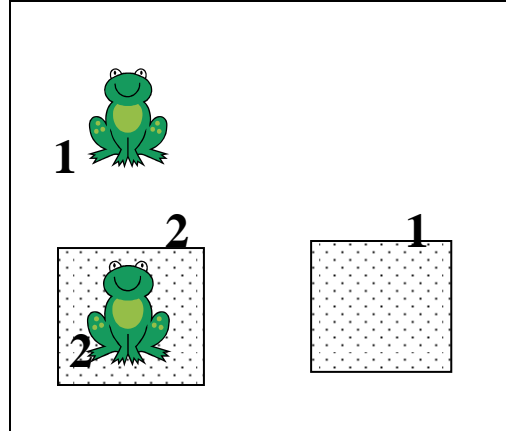
Figure 3

As a matter of record, children never selected the napkin (i.e., napkin 2) that already contained a frog as a destination in executing the action corresponding to the phrase *Put the frog on the napkin*. The question, then, is why children selected the empty napkin as the intended referent of the second NP *the napkin*. This was the object selected by children in both the Trueswell et al. study and in Experiment I. In analogy with the proposal we just made about children's inference about the speaker's intended referent for the NP *the frog*, we propose that children chose the empty napkin as the referent of the NP *the napkin*, on the grounds that the empty napkin did not contain any frog. Roughly the child would reason like this: I know I have to move this frog on a napkin but there are two napkins in the context…which one should I consider?.. I know, the one that does not yet have a frog on it!". Things are not so simple, however, because once children selected the napkin without a frog (napkin1), the other frog – the frog

already on a napkin (frog2) — could also be considered as a potential referent. Although that frog was already on a napkin (napkin2), it was not on the napkin which does not have any frog (napkin1). In other words, suppose the child has decided that the intended destination is the empty napkin (napkin1), now she has to decide which frog to move on that napkin. The child could reason that 'I have to move a frog on the empty napkin (napkin1), it must be the frog that is not already on that napkin…. However, both frogs are not on napkin 1." At this point the pragmatic inference which could be used to identify the intended frog reaches an impasse. As a result, the child should not know which frog to move.

This scenario illustrates the problem one would face if he already knew the intended referent for the definite NP *the napkin*. Let us now consider a scenario in which the child knows the intended referent for the first NP *the frog*. Suppose that the child has decided which frog to move: it is the one not on a napkin (frog1). The second step will be for the child to select the intended referent for the definite NP *the napkin*. He could reason as follows: "Okey, I have to move this frog (frog1) on the napkin….which napkin?" Again, there are two napkins this frog (frog1) could be moved to! Once again the child would not know what to do.

In short, the problem illustrated here is due to the fact that we are appealing to the same mechanism, a pragmatic inference, to identify the referents for the two definite NPs contained in the sentence. The result of applying the

relevant pragmatic inference to identify the intended referent for one definite NP, whichever that is, affects the possibility of finding the intended referent for the other. A way out could be to make the result of the application of the pragmatic inference for one definite NP irrelevant for the other definite NP. In other words we could propose the child performs a pragmatic inference of the kind described below:

(21)   a.   *the frog* = the frog that is not an <u>any</u> napkin

        b.   *the napkin* = the napkin which does not have <u>any</u> frog

Regardless of which napkin has been selected, the inference in (21)a would allow one to identify the intended referent for the NP *the frog*. In same way, regardless of which frog has been selected, the inference in (21)b would make it possible to identify a referent for the NP *the napkin*.

       Our assumption exploits the intuition that when there are two contextually dependent elements in a sentence, these elements are not resolved one as a function of the other, rather they are analyzed independently. A natural question is whether anything of this sort is exemplified in different cases. It seems that one such case is the following:
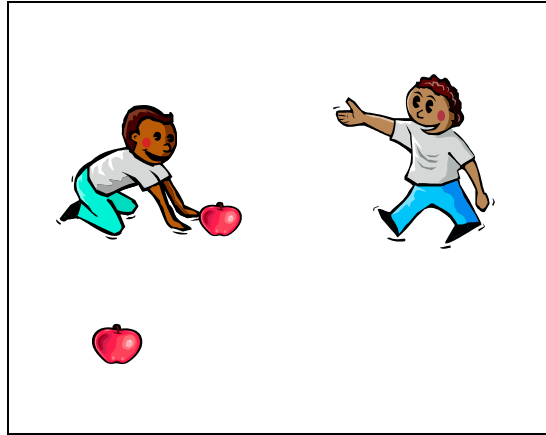
Figure 4

(22)   Give him the apple.

Suppose somebody is given the instruction in (22) relative to the context depicted in Figure 4. It is reasonable to assume that when asked to perform (22) subjects would give the apple that is unclaimed to the boy who dopes not have any apple. In order to execute the instruction in (22), one has to identify first, the referent of the pronoun 'him', and second, the referent of the definite NP *the apple*. Notice that, as illustrated before, the two referential expressions cannot be interpreted as dependent one from one other. In fact, if the pronoun (the receiver) is identified first (is the boy who has not been given anything yet), both apples would be possible referents for the NP *the apple*. Similarly, if the definite NP (what is given) is identified first, (it is the apple that has not been given to anybody) then both boys could be the receivers of that apple. The solution would be once again

to assume that the process of interpreting two referential expressions by means of applying a pragmatic inference is a two step process: one step being independent from the other. Unfortunately, we have nothing to offer as to why this constraint should hold.

A possible way out of this impasse is to assume that the visual display readily suggests that each frog is in a unique relation with one napkin. In a sense, a sentence like *Put the frog on the napkin* in presence of that display is equivalent to *Put the frog on its napkin*. Thus the listener's task is to find the uniquely salient frog such that that frog is not on its napkin. The idea is that the visual display suggests a series of pairings between frogs and napkins, such that the listener does not have to look for a uniquely salient frog and a uniquely salient napkin, but rather for a uniquely salient pair frog-napkin for which the state of affairs requested by the command does not hold at the time of the utterance

It is time to take stock. So far we have illustrated how children compute a pragmatic inference to identify the speaker's intended referent for a definite NP in situations in which the uniqueness requirement is not strictly satisfied. Our claim is that the notion of felicity condition associated with the command is the triggering cue for the pragmatic inference. The felicity condition leads the hearer to assume a contrast between the state of affairs that holds at the time the command is uttered and the desired state of affair. The present discussion, however, should not make us lose track of our main objectives. In the previous

chapter we contended that the experimental setting employed in the Trueswell et al. study does not necessarily support the conclusion that children do not appeal to contextual cues in order to resolve correctly (NP-attachment) a temporary ambiguity like the one in *Put the frog on the napkin into the box*. To be more specific, in a context with two frogs, the assignment of NP-attachment of the PP *on the napkin* is not the only way for children to identify the intended referent for the definite NP *the frog*, as supposed by Trueswell et al.. An alternative mechanism was proposed, a pragmatic inference. This mechanism depends on the properties of the objects in the context and on the conditions on the use of a particular kind of speech acts: commands. If we are on the right track, children are much more knowledgeable than they have been credit for in previous work.

In the rest of the chapter, we will examine the nature of the pragmatic inference by children in more detail. On the account we have advanced, the inference takes place when the PP *on the napkin* is attached to the VP. Two factors play a role. First, children interpret the PP *on the napkin* as a destination of the putting event. Thus, one should investigate what factors would prevent children from attaching the PP to the verb. Second, given a VP attachment parse, children carry out a pragmatic inference. Thus, one should investigate under which conditions such a pragmatic inference could be inhibited. These are the topics of the remainder of this chapter. We start with the latter.

3.5   Semantic constraints on the pragmatic inference

In this section we investigate semantic constraints on the pragmatic inference about the speaker's intended referent for definite NPs. We would suggest that the semantic structure of the target sentence plays a role in deciding whether children compute a pragmatic inference about the speaker's intended referent for definite NPs in expressions like *Put the frog on the napkin*. In particular, we would like to argue that if the instruction is changed to something like (23), children's responses may vary, possibly depending on whether the adjective ADJ is interpreted as appositive or as contrastive.

(23)   Put the frog on the ADJ napkin.

For example, if the adjective is interpreted as a contrastive adjective, then children will carry out a pragmatic inference along the lines of (24). By contrast, if children interpret the adjective as appositive, then children will attempt to carry out a pragmatic inference along the lines in (25).

(24)   Put the frog that is not on a ADJ. napkin on the ADJ. empty napkin.

(25)   Put the frog that is not on a napkin on the empty napkin, which happens to

         be ADJ.

Before we illustrate our proposal with an example, we review previous work on

the use and interpretation of adjectives, which points to an interesting difference

in the processing of scalar and color adjectives with adults.

     One study was conducted by Sedivy (2005). The experiment was an

elicited production task to examine the pattern of production of adjectives in

contexts with and without a referential contrast between two objects of the same

kind. The goal of the experiment was to determine whether participants would

produce scalar and color adjectives to refer to the target object. The results show

that adult speakers of English use color adjectives regardless of whether a

referential contrast was involved. By contrast, scalar adjectives are almost never

produced in contexts without a corresponding contrast.

     A comprehension study was also conducted by Sedivy, Tanenhaus,

Chambers and Carlson (1996) and Sedivy (2001). The study showed that color

adjectives (e.g., blue), as compared to scalar adjectives (e.g., tall, big), are not

interpreted contrastively. For example, in a series of eye-tracking experiments by

Sedivy et al. (1996), subjects were shown displays with four objects, and they

were instructed to move various objects. One set of instructions contained scalar

adjectives, such as *Pick up the tall glass*. The finding was that subjects identified

the target object (the tall glass in the display) from a competitor object (an object that could have been described using the same adjective *tall*) more quickly when a contrasting object of the same category of the target object (a short glass in the display) was present, as compared to trials that did not contain a contrasting object. The findings were interpreted as evidence that participants systematically used the contrastive interpretation of prenominal scalar adjectives. For present purposes, the relevant finding is that color adjectives were not found to exhibit the same contrastive function (as scalar terms) in similar contexts (Sedivy, 2001). For example, when presented with a display containing different objects and asked to *Pick up the blue cup*, the presence in the display of a contrastive object (a red cup) did not facilitate the identification of the target object.

With past research in mind, we assume that scalar adjectives tend to have a contrastive interpretation whereas color adjective tend to have an appositive interpretation. Thus, it is possible that upon encountering a sentence like (26) children will interpret the instruction as in (27). Crucially, this is an instruction that can be carried out in a context like the one depicted in Figure 6, since that figure contains a frog that is on the small napkin and a frog that is not.

(26)   Put the frog on the small napkin.

(27)   Put the frog that is not on any small napkin on the small empty napkin.
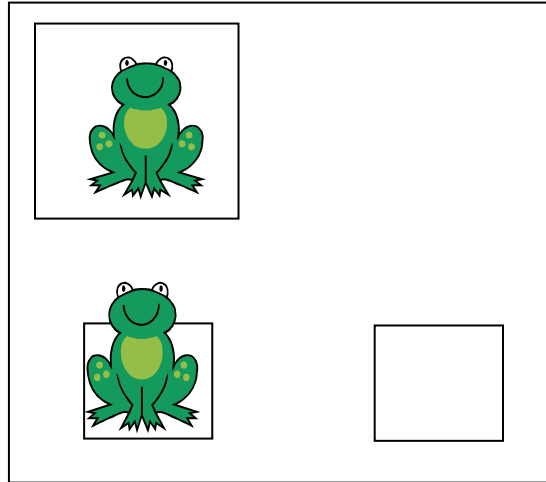
Figure 6 – The Scalar Adj. context

By contrast, upon encountering a sentence like (28) children can interpret the instruction as in (29). Importantly, this is an instruction that cannot be carried out in a context like the one depicted in Figure 7, since in that figure both frogs are already on a napkin.

(28)   Put the frog on the red napkin.

(29)   Put the frog that is not on any napkin on the empty napkin, which happens to be red.
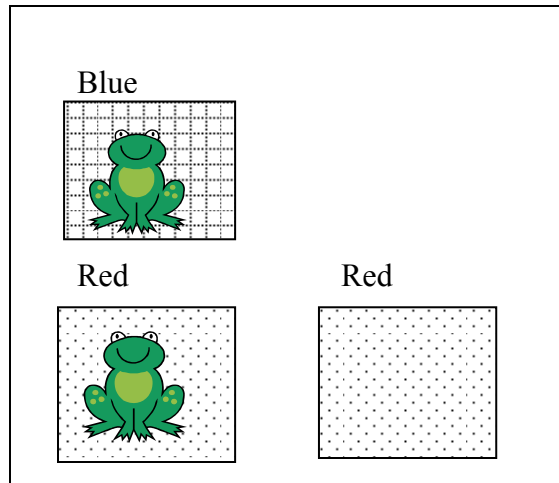
Figure 7: The Color Adj. Context

3.5.1 Experiment II

To evaluate this hypothesis we conducted an Act-out task. The experiment had two conditions: the Scalar Adjective Condition and the Color Adjective Condition. In the Scalar Adjective condition, a group of 15 children (age from 3;09 to 5;4 - mean age: 4;8) were presented with a context with two frogs, each one on a napkin of a different size -- one big and one small. In addition, there was an empty small napkin, as illustrated in Figure 7. Children were given instructions, such as (30).

(30)   Put the frog on the small napkin.

(31)   Put the frog that is not on the small napkin on the small empty napkin.

Our prediction was that children would interpret (30) as an invitation to carry out

the instruction in (31). As a consequence, children would be able to perform a

pragmatic inference. They will move the frog that is not already on a small napkin

and put it on the small empty napkin.

        In the Color Adjective Condition, a different group of 15 children (age

from 3;10 to 5;8- mean age: 4;7) were presented with a context with two frogs,

each one on a napkin of a different color -- one red and one blue. In addition,

there was an empty red napkin as illustrated in Figure 7. Children were given

instructions, such as (32).

(32)   Put the frog on the red napkin.

(33)   Put the frog that is not on the napkin on the empty napkin, which happens

         to be red.

Our prediction was that in this condition children would interpret (32) as a request

to carry out the instruction paraphrased in (33). Thus children would not be able

to perform a pragmatic inference, given the fact that both frogs are already on a napkin.

As expected, all of the children tested in the Scalar Adjective condition experienced no difficulty in identifying which frog in the experimental workspace should be moved. Children moved the frog that was not on the small napkin onto the small (empty) napkin 90% of the time. Interestingly, children never asked "which frog?". By contrast, the children tested in the Color Adjective Condition experienced difficulty in identifying the intended referent of the initial NP *the frog*. In the first two trials, children consistently displayed confusion, and queried the experimenter about "*which frog?"* to move on 18 out of 24 trials.[30][31] To that question the experimenter replied by saying: *the one you want* or *which one do you think*? To which the child reacted usually by developing a strategy (i.e., moving the object closer to them). Over all of the trials, moreover, children behaved at chance in selecting one of the two frogs to move. Interestingly, in the last trial children were asked to explain the reason for selecting the frog they had moved on that trial; children consistently answered "it doesn't matter" or "it's the same." This also contrasts with the findings of Experiment I, where children consistently carried out a pragmatic inference and explained that they had selected

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[30] The 24 trials under consideration correspond to the first two trials for each child.

[31] These results also bear on the interpretation of Experiment I. As the reader may recall, in that experiment children performed a specific action. One might wonder whether in that experiment children could have behaved in any different way. The results of the present experiment show that, when presented with a command children can indeed question the experimenter's intentions.

the frog that was not on a napkin on the grounds that the other frog was already

on a napkin.

3.6 Syntactic constraints on the pragmatic inference

As we have seen, there is a general preference for VP-attachment for the PP *on

the napkin* in a sentence like *Put the frog on the napkin (into the box)*. As we saw,

many accounts have been offered to explain this preference. For instance, Frazier

(1978; 1987)[32] claimed that VP-attachment is to be preferred over NP-attachment

because the syntactic structure associated with VP-attachment is simpler (by

virtue of containing less syntactic nodes). The parser will thus prefer the simpler

structure in an attempt to reduce memory load. Other proposals draw upon the

notion of thematic roles assigned by predicates. For example, according to some

authors the parser prefers to fill the theta grid of a predicate as soon as possible,

leaving as few unassigned theta roles as possible (e.g. Pritchett, 1988, 1992;

Gibson, 1991; Weinberg, 1992).

This line of research draws upon the lexical properties of the verb *put*. In

fact, the verb *put* obligatorily assigns three theta roles, an Agent, a Theme and a

Destination role. For the purposes of the present study, we can consider only the

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[32] But see also Kimball (1973)

Theme and the Destination Theta roles. These theta roles are usually realized by a noun phrase and a prepositional phrase, respectively. Thus, in interpreting the string *Put the frog on the napkin* the parser assigns the Theme theta role to the NP *the frog* and it assigns the Destination theta role to the PP *on the napkin*. Having discharged the theta roles associated with the verb, the string can constitute a complete utterance. As a consequence, the listener attempts to carry out the instruction associated with the string in accordance with the parse that is being entertained (VP-attachment of the PP). If this reasoning is on the right track, then a different parse of the string would give rise to a different instruction. This result could be achieved by considering, for example, a verb which does not necessarily assigned a Destination Theta role. One such verb could be *move*.

3.6.1 *Experiment III*

To evaluate the role of the Theta roles associated with the verb, we conducted an Act-out task as Experiment I. In one of the trials, children were presented with the same lay-out as in Experiment I in Section 4.2 (here reported as Figure 8) and asked to perform the action in (35) rather than (34):
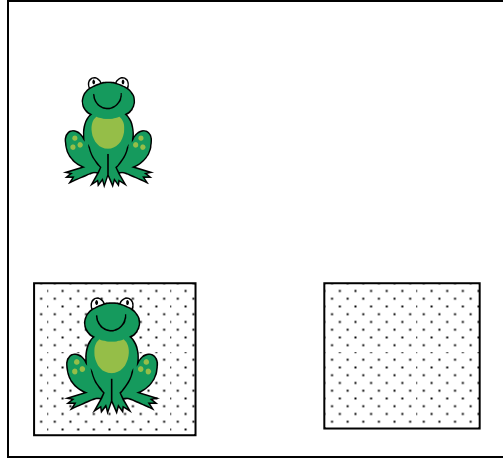
Figure 8: On/off Context

(34)   Put the frog on the napkin.

(35)   Move the frog on the napkin.

Since the verb *move* does not necessarily assign a Destination theta role, our

hypothesis was that children would be equally likely to interpret the PP *on the*

napkin as a destination and as a modifier of the preceding NP *the frog*.[33] The

Theta roles are discharged on either analysis, so the sentence *Move the frog on the*

napkin can be construed as a complete sentence on either analysis. Depending on

which parse is entertained, however, a different instruction would result. So, for

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[33] We are aware that *move* could also be associated with a destination interpretation in a similar way to the verb *put*. We could have thus chosen other kind of verbs for which a destination interpretation was not possible, as the verb *touch* for example. However, our purpose was to compare two verbs which could both occur with a PP (interpreted as destination of the action); but two verbs which also differ in that one verb (i.e. *put*) requires the Destination Theta role while the other (i.e. *move*) does not. We think any other comparison would have been irrelevant.

example, if the Destination interpretation is chosen, children will interpret the string in (35) as paraphrased in (36). On the contrary, if the PP *on the napkin* is interpreted as a modifier of the NP *the frog*, children will interpret the string as paraphrased in (37).

(36)   Move the frog towards the napkin.

(37)   Move the frog that is on the napkin

Fifteen children (age from 3;9 to 6;1- mean age: 4;9) participated in this experiment. The experimental hypothesis was that children would resort to the pragmatic inference less frequently than in Experiment I. This expectation was upheld; children moved the frog that was not already on the empty napkin only 55% of the time vs. 92% of the time of Experiment I. In the remainder of the trials, children choose the frog that was already on a napkin and moved that pair frog-napkin to various locations in the experimental work space: sometimes towards the other napkin, sometimes towards the other frog. Another common action was to move the frog from the napkin it was on, off the napkin and place it close to the other frog, which was already off a napkin. Interestingly, children were not puzzled about which frog to select as they were in the adjective condition experiment. They either selected the frog off the napkin, and they

performed the pragmatic inference in analogy with the *put*-sentences (thus putting this frog on the empty napkin)[34], or they selected the frog already on a napkin. In this case they looked puzzled as to *where* to move the frog they had selected. Children often moved that frog close to the other frog and then looked at the experimenter asking *here*? The findings suggest that some children interpreted the sentence in (35) as paraphrased in (36), while others interpreted (35) as paraphrased in (37), as expected on the view that the lexical properties of the verb play a role when both interpretations equally conform to the Principle of Referential Success.

The results also suggest that children's attempt to carry out a pragmatic inference is affected by the parse that they have assigned to the target sentence. Thus, it would not be surprising if children's behavior in the setting of Trueswell et al. (1999) also turned to change depending on the verb that is used. In fact, if children are presented with a verb for which VP-attachment preference is not operative, they will simply select NP-attachment. In turn, this means they will not need to resort to a pragmatic inference in order to identify the referent of the definite NP.

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[34] This is a legitimate action since, as we pointed out in ft.10, the verb move followed by a PP can have a destination interpretation.

3.7 Conclusions

Let us summarize the findings of the present chapter. We started by drawing upon children's ability to carry out pragmatic inferences, and we investigated which factors can affect this ability. Our findings show that children's attempts to perform pragmatic inferences can be affected by syntactic constraints (i.e., lexical properties of the verb involved) as well as semantic constraints (i.e., properties of the command and the nature of the adjective used in the same sentence). The task of the next chapter is to design a new study investigating children's adherence to the Principle of Referential Success which would take into consideration children's ability to perform pragmatic inferences, as discussed in the present chapter. Thus we are back to square one. Where Trueswell et al. began. The 'right' study of the issue remains to be done, but now we are in a position to design an experiment that controls for a number of factors that we have identified as possibly leading to the wrong conclusions about children's use of context in parsing.

Chapter IV

4.1   Introduction

Chapter II described an experiment conducted by Trueswell et al. (1999) to assess

children's ability to resolve the temporal syntactic ambiguity occurring when the

verb *put* is followed by two Prepositional Phrases as in *Put the frog on the napkin*

into the box. The findings led Trueswell et al. (1999) to conclude that (a) children

are less able than adults to use the referential context to guide their on-line parsing

decisions, at least under certain processing conditions, and (b) children are unable

to retrace their footsteps, once led down a garden path. Ina arguing against the

first conclusion, we pointed out that the 2-Referent Context does not effectively

support (or at least not immediately) NP-attachment of the first PP. The point was

that the definite NP *the frog* could be easily assigned a referent under a VP-

attachment scenario, by means of a pragmatic inference, for which there is both

provided theoretical justification and experimental evidence. It remains to be

explained why (some) children behave differently from adults, continuing to

maintain the VP-attachment even after hearing the second PP *into the box*, which should have signaled to children that they had been led won a garden-path. Children's non-adult behavior is attested in the 2-Referent Context as well as in the 1-Referent context.

Assuming that children have reasons to attach the PP *on the napkin* to the VP, the question is why they are unable to revise their initial interpretation, what prevents children from revising their initial parse? It seems that children differ form adults in this ability. The problem under discussion is particularly relevant for the 2-Referent Context, where a different attachment possibility is made salient by the context (i.e., NP-attachment). To address this issue we will draw upon previous research investigating linguistic constructions different from sentences containing two prepositional phrases. A common feature to the various constructions we consider is that research with young children has highlighted children's eagerness to carry out verbal instructions.

4.2 Extra-linguistic components of children's behavior

When someone is asked to act out the meaning of an utterance (i.e., executing a command), her task includes the assignment of an interpretation to the sentence, relying on principles provided by the syntax and the semantics. In addition to this,

however, the subject must also generate a plan for carrying out the appropriate actions corresponding to the linguistic input, using the objects available in the experimental workspace. Plans are created and used in concert with other aspects of language processing. These additional elements of processing involve the outputs of semantic components (which in turn depend on the output of syntactic components), as well as components of the language apparatus that are responsible for accessing linguistic principles and coordinating their use, e.g., verbal working memory. The process of devising a plan and executing it may be separated in time, or they may be interleaved in time. In other words, one could delay the execution of the plan until after the entire plan has been devised. Alternatively, , one may start acting on the entities available in the experimental workspace as soon possible. Drawing upon the terminology of computer languages, Hamburger and Crain (1982; 1984; 1987) refer to these possibilities as 'compile mode' and 'interpret mode' behavior respectively.

The two possible strategies for plan execution for execution of a plan are invoked by Hamburger and Crain to explain the results of different act-out tasks. They suggest that children tend to adopt the interpret mode to a larger extent than adults do. If they are correct, then children give in to pressure to execute subcomponents of the plan they are formulating as soon as possible. On this view children's less are less 'automated' or 'compiled' than thos of adults, possibly as a consequence of children's limited capacity in verbal working memory. Because of

this, children are forced to interleave planning and execution, they tend to act out parts of the plans they are formulating, before all components of planning have been completed.

In several studies, it has been found that children's errors in performance arise because children begin to execute plans before all of the requisite planning has been completed, i.e., they engage in interpret mode behavior. Because of pressure to interpret language on-the-fly, children tend to (sometimes mistakenly) act out verbal instructions sequentially, i.e., in the order in which the components of planning can be formulated, based on the linguistic input. As a consequence, children sometimes act out the meanings of sentences in an order-of-mention fashion (Amidon and Peter, 1972; Crain, 1982). There are several examples of children's premature execution of linguistic instructions in the literature on child language.

Sentences with a restrictive relative clause, such as (1), illustrate the phenomenon of interpret mode behavior of children. In an Act-Out ('do-what-I-say') task with four- to six-year-olds, the child subjects were instructed to act out the sentence in (1) in a workspace that contained one dog, one cow, and one sheep (e.g., Sheldon 1974; Tavakolian 1981).

(1)   The dog pushed the cow that jumped over the fence.

Children often responded by making the dog push the cow first, and then making the dog jump over the sheep. This response is not appropriate for sentence (1), but it is appropriate for sentences like (2), with conjoined clauses.

(2)   The dog pushed the cow and jumped over the fence.

This observation led some researchers to conclude that children assign a 'conjoined clause analysis' to sentences with relative clauses (Tavakolian, 1981).

The introduction of additional cows into the experimental setup sharply reduced children's errors in a subsequent study, however. Presumably the additional objects permitted the relative clause to serve its proper pragmatic function – that of restricting from a set to a subset (of the appropriate size) of the original set. Satisfying the felicity conditions associated with linguistic expressions seemed to enhance children's ability to compile the entire plan before starting its execution, according to Hamburger and Crain (1982; 1984; 1987).

From the planning viewpoint, another relevant finding appeared in the Hamburger and Crain study. That study was designed to satisfy the restrictive function of the relative clause. Although children acted out sentences like (1) correctly selecting one member of the set of cows as the referent of the expression *the cow that jumped over the fence*, the specific sequences of actions that children performed differed as a function of age. In response to (1), four-year-old children

(and audits) made the cow jump over the fence first, and then made the dog push the cow. That is, four- year-olds acted out the content of the relative clause <u>before</u> they acted out the content of the main clause. Conceptually, this makes sense, because it is *the cow that jumped over the fence* that the dog pushed. By contrast, three-year-old children acted out the two clauses in an order-of-mention fashion, main clause first. According to Hamburger and Crain, the order-of-mention result is a hallmark of the interpret mode at work in child language. Children act out subcomponents of the plan as soon as they devise those subcomponents. These, in turn, correspond to fragments of the linguistic instruction that they hear.

There are other examples of the interpret mode leading to mistakes by young children. One example was uncovered when children asked to respond to sentences containing the temporal terms *before* and *after*. Consider the examples in (3) and (4).

(3)   Pick up the helicopter after you pick up the car.

(4)   After you pick up the car pick up the helicopter.

Several studies found that children picked up the objects in the wrong order in response to the requests like (3), whereas they responded 'correctly' to ones like (4) (Amidon and Carey, 1972; Clark, 1971). This is another order-of-mention

result. And again, changes in experimental design were found to reduce children's errors in a subsequent study (Crain, 1982). The study by Crain (1982) modified the experimental situation, so that a child had already expressed her intent to perform the action mentioned in the subordinate clause (i.e., to pick up the helicopter) before the test sentence was presented. As a result, requests like the one in (3) were almost never misinterpreted, despite the conflict they exhibit between order-of-mention and the correct conceptual order.

From a planning perspective, both children's errors and the disappearance of those errors in certain experimental paradigms can be readily explained. The errors are an order-of-mention phenomenon, resulting from the interpret mode behavior. However, when the child expresses the intent to pick up the helicopter in response to the instruction in (3), the child is mentally computing a plan to perform the action mentioned in the subordinate clause. Formulating the plan for that part of the action in advance makes it easier for the child to compile the plan for the entire sentence.

The final example of plan assembly and execution by children involves phrases with prenominal modifiers like *second striped ball*. In a study of children's command of phrase structure, Matthei (1982) reported systematic non-adult behavior by children when they were asked to perform the instruction in (5), using an array of objects similar to the one depicted in Figure 1:

(5)   Point to the second striped ball.
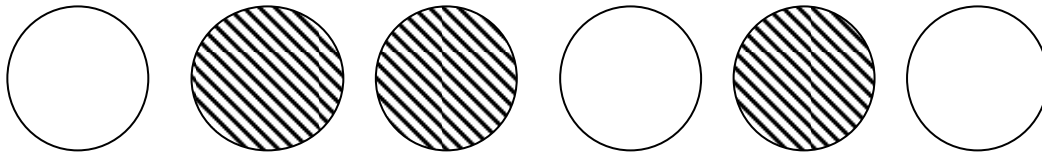
Figure 1

When adults were given the same instruction (counting from the left), they

consistently pointed to the second of the striped balls, i.e., the third object (from

the left) in the array. By contrast, 4- to 6-year-old children often pointed to the

second ball in the array, which happens to be striped. Hamburger and Crain

(1984) raised the possibility that "the child subject… might start to plan and even

act while the sentence is being uttered, possibly making a premature and incorrect

decision." Consistent with this hypothesis, children's 'errors' vanished when the

experimenter produced the test sentence before the child had a chance to execute

any action. One way this result was achieved was for the experimenter to hide the

experimental display from the child until the sentence has been uttered. This

feature of experimental design was called *phrase-and-then-display* by Hamburger

and Crain. In such circumstances, the child could (mentally) devise a plan in

compile-mode, as adults do. If so, children should be expected to perform

conceptually correct sequences of actions, just as adults do. As a matter of record,

children correctly pointed to the right ball (i.e., the third ball in the array) when

the *phrase-and-then-display* methodology was employed in the study by

Hamburger and Crain.

To sum up, this section reviewed previous studies investigating children's

interpretation of different linguistic constructions. All of those studies involved an

Act-Out task, a task which requires the child to interpret instructions and to carry

out the relevant actions. Focusing on the particular responses that children gave in

previous studies (i.e., an order-of-mention response), Hamburger and Crain

(1984) concluded that children's behavior should not be taken as evidence of a

failure to access the adult interpretation of the relevant construction. Rather, they

argued that children's behavior was dictated by their eagerness to execute

subcomponents of the plan as soon as these were devised. Given the possibility

that children's behavior in act-out tasks is affected by children's failure/reluctance

to delay the execution of the plan until the entire plan is devised, it is worth

considering whether the act-out task employed by Trueswell et al (1999) was

open to the same problems.

4.3 Interpretation and Planning in the Trueswell et al. (1999) study

Returning to the Trueswell et al. findings, it is readily apparent that once children

begin to plan or even to execute a response, in both the 1-Referent and the 2-

Referent Contexts, they are unable to revise the cognitive algorithms (i.e., the

response plans for acting out the meanings of linguistic expressions), which they

have begun to execute. Based on previous research, we assume that children only

gradually develop the performance routines needed to delay the immediate

execution of plans. Here is what we are suggesting. Children's inability to revise

their initial interpretation in the 2-Referent Context (where an alternative is

contextually available) may be the result of the interpret-mode behavior.[35] In

particular, children may have formulated a plan and even started to execute it

before the entire instruction *Put the frog on the napkin into the box* had been

uttered by the experimenter. Specifically, children may have planned a specific

course of action that interpreted the first PP *on the napkin* as referring to the

destination. Having committed to putting the frog (that was not on a napkin) on

the empty napkin (via the pragmatic inference described in the last chapter), it

proved untenable for children to revise their formulation of the plan, because the

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[35] Remember that in the 1-Referent Context, a garden path effect at the occurrence of the second
PP was expected. This was indeed the case for both children and adults: however, it manifested
itself differently. While children moved the (only) frog onto the empty napkin, adults only looked
at the empty napkin. In other words, adults initially considered the destination interpretation of the
first PP but were able to revise this interpretation, while children were not.

action they were committed (and possibly even started) to perform could not be integrated into any appropriately revised plan.[36]

If this line of reasoning is correct, then children differ from adults, in part, because children assemble plans and begin to execute them in the interpret-mode, rather than in the compile-mode, as adults do. We have seen, however, that it is possible to render the interpret-mode inoperative, in the discussion of children's interpretation of phrases like *second striped ball*. We saw that, the experimental maneuver of *phrase-and-then-display* sufficed to elicit compile-mode behavior from children. It is expected that children will perform like adults, then, if the *phrase-and-then-display* methodology is implemented in studies of PP attachment. An experiment is presented in this chapter demonstrating that children do not commit errors in responding to instructions like *Put the frog on the napkin into the box* in the *phrase-and-then-display* condition, presumably because this experimental manipulation prevents children from prematurely executing pieces of the plans they generate.

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[36] A better look at children's mistakes shows that an attempt to solve this impasse was indeed done by some children. In fact, as seen earlier, one common mistake involved moving the wrong frog (the one off the napkin) on the empty napkin and then into the box. Another common mistake involved moving the wrong frog (the one off the napkin) on the empty napkin and then the right frog (the one on the napkin) into the box. Both these mistakes can be viewed as an attempt from the children to revise their action based on the new information coming from the linguistic input.

4.4 Blocking the interpret mode and the pragmatic inference

Our hypothesis is that children's non-adult behavior in sentences like *Put the frog on the napkin into the box* is the result of the co-action of two factors, which we extensively discussed. First, the 2-Referent Context – one frog on a napkin, one frog off a napkin-- is such that children can perform a pragmatic inference, which allows them to assign a referent to the definite NP *the frog* as soon as it occurs. Second, as we have just seen, children could start assembling a plan (and executing it) before the whole sentence is uttered.

Thus, an important step towards designing the right experiment to test children's ability to resolve syntactic ambiguities of sentences containing two PPs is to find a way to inhibit children's eagerness to formulate (and execute) a plan and to inhibit the possibility of performing a pragmatic inference to identify the uniquely salient referent of the definite NP *the frog*. In the preceding section, we considered an experimental maneuvers that could lead to improved behavior by children, by erasing the effects of one impediment to children's successful performance. In particular, we have discussed how to render the interpret-mode inoperative. For example, based on previous empirical evidence we hypothesized that the experimental maneuver of *phrase-and-then-display* should suffice to elicit the compile-mode from children in response to sentences like *Put the frog on the napkin into the box*. Similarly, we have discussed how we might go about

inhibiting children's pragmatic inference by using color adjectives. This brings us, at last, to an experiment we designed to investigate children's resolution of temporary ambiguities, which is not vitiated by the problems of the original study by Trueswell et al. (1999).

4.4.1 Experiment IV

In order to address the confounding factors that affect the Trueswell et al. study, we conducted an experiment similar to the 2-Referent Context condition employed by Trueswell et al. (1999). We introduced two changes in the design, however. One change was to use color terms in the instruction: this was done to inhibit the pragmatic inference that we discussed in the last chapter. The second change was to implement the *phrase-and-then-display* condition, to impede children's premature formation (and execution) of a response. The experimental hypothesis was that these experimental procedures would result in 'correct' adult interpretations and actions.

To inhibit the pragmatic inference, both the relevant objects were positioned on a platform of the same kind, but of a different color, so that only a color adjective could be used to distinguish between them. For example, one trial was about two frogs, both of which were on a napkin (one red, one blue), and there was an empty, red napkin (Figure 2).

111
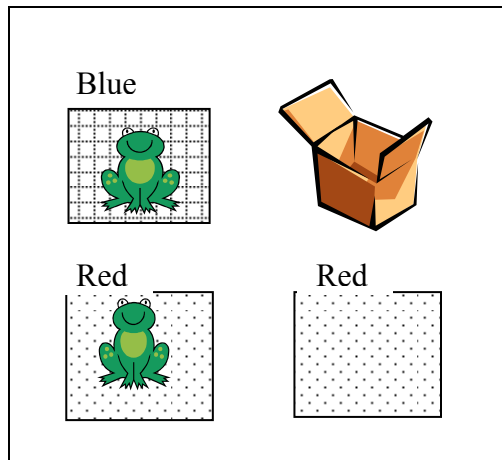
Figure 2: the two-color-referent context

Second, to implement the *phrase-and-then-display* maneuver, children were introduced with the lay-out depicted in Figure 2 in the most neutral way. In so doing, we avoided leads-in that could have biased children toward one interpretation over the other, thus affecting our results. For example we never mentioned that one object was on a platform while the other was misplaced. We also avoided the use of the preposition *on* in describing the context, in order to block earlier inferences. Children were simply told that a puppet, Kermit the Frog, manipulated by one of the experimenters, had a special project it wanted to study. Then, while the puppet was entertaining the child, the other experimenter placed the objects on the workspace in front if the child. After being introduced with the scene, children were asked to turn away while they were listening to the instructions, which contained a temporary ambiguity, as in (6).

(6)   Put the frog on the red napkin into the box. [37]

Only after hearing the entire sentence, children were allowed to look at the

scene again and perform the action they were asked to.

We interviewed 22 children in the same age range of those tested in the

Trueswell et al. study. More precisely, the children who participated in the present

experiment ranged in age from 3;09 to 5;09, with a mean age of 4;08[38] Each child

was presented with 4 target trials, four fillers and one warm-up. All and only the

target trials were instructions containing the verb *put* as illustrated in (6)[39].

As predicted, the child subjects performed the correct action 89% of the

time. (i.e., on 78 of 88 trials). The findings suggest that children's failure to use

referential information in previous research was due to their tendency to

formulate response plans on the fly, which in turn exploited their ability to make a

pragmatic inference in order to individuate the referent of the definite NP.

Before firm conclusions can be drawn about the results of the present

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[37] Despite the occurrence of a color adjective in the instruction, a temporary ambiguity emerges in (6) after the first PP as in the Trueswell at al. study.

[38] The children who participated in Experiment III did not participate to Experiment I or II.

[39] The choice of not having simple sentences containing the verb *put* as filler trials, as in *Put the frog in the box*, now *put it back* was motivated by the fact that in kind of sentences the PP immediately following the NP must be interpreted as a destination. As a consequence, children might be biased towards a destination interpretation. This is also what we think happened in the Trueswell et al. experiment.

experiment, however, we need to rule out the possibility that the experimental

maneuvers we introduced in the present experiment, using a modified version of

2-Referent Context, would improve children's responses even in the 1-Referent

Context. That is, the changes that were introduced (*phrase-and-then-display* and

the use of prenominal adjectives) might have increased children's willingness to

interpret the initial PP as a modifier, regardless of the specific context. If so, then

the present study would only show that children are capable of interpreting PPs as

modifiers. To control for this possibility, we conducted two experiments: the first

experiment, Experiment V, was designed to control the effect of prosody. This

experiment includes the use of prenominal color adjective in the target sentence in

the classical 2-Referent Context where one of the frogs is on a napkin while the

other is not. The second control, Experiment VI, incorporates the *phrase-and-
then-display* methodology and the use of prenominal adjective in the 1-Referent

Context.

4.4.2. Experiment V

The present experiment was designed to investigate whether (the presence of) an

adjective and the corresponding change in prosody might have been responsible

for children's improved performance in Experiment IV. Research on adult

sentence processing has shown that adults can make use of prosodic information

in determining the syntactic structure of an utterance (see Watson and Gibson, 2004). Although the role of prosodic information in the case at hand seems to be very limited (see Snedeker and Trueswell, 2003), we decided to conduct an experiment employing one of the contexts in which children have been showed to experience problems. Such context is the classical 2-Referent Context in Figure 3 below. Children were then asked to act out the instruction in (7), relative to the context in Figure 3:
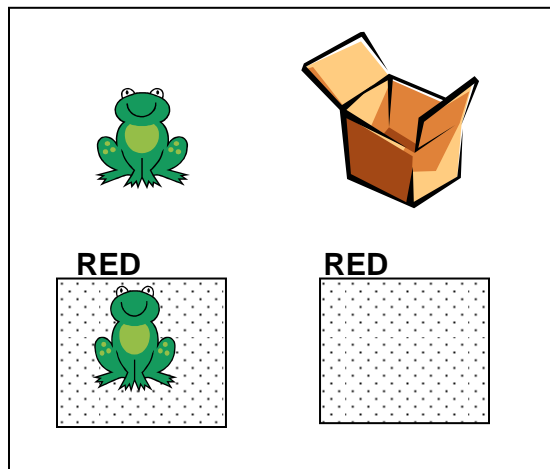
Figure 3 – two-referent context

(7)   Put the frog on the red napkin into the box.

The context depicted in Figure 3 is the same context which elicited children's

incorrect responses 39% of the times in the Trueswell et al. study. The only

difference implemented in the present experiment is in the target sentence which

contains a prenominal adjective. Notice that the use of the color adjective in (7) is

somehow redundant since it does not add any relevant information. The two frogs

in the context could be distinguished in virtue of their being on or off a napkin

regardless of the color of such napkin. However, this does not constitute a

problem since, as illustrated in the previous chapter, adjectives could be used

naturally in a redundant or appositive way (see Sedivy, 2002; 2004). Moreover,

since the empty napkin is also red, children could still being led down the garden-

path, thus interpreting the PP *on the red napkin* as a destination. Let us recall that

when presented with the context in Figure 3 and asked to *Put the frog on the*

napkin into the box in previous studies children perform the right action (moving

the frog that is on the napkin into the box) less than 50% of the time.[40] By

analogy, we would expect the same percentage of correct actions in the present

experiment too. This is assuming, as we do, that the presence of the prenominal

color adjective in the instruction does not increase children's ability to access a

modifier interpretation of the first PP per se. If, on the contrary, the presence of

the prenominal adjective in the instruction does affect children's interpretation of

that PP, then one would expect a significant increase in the number of children's

right actions.

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[40] To be precise, 39% of the time in the Trueswell et al. study.

We interviewed 15 children (age from 3;05 to 5;03; mean age 4;05).[41] Each child was presented with 4 target trials, four fillers and one warm-up. All and only the target trials were instructions containing the verb *put* followed by the preposition *on*, as illustrated in (7) above. As for the results, children performed the right action only 32% of the time, consistently choosing the frog off a napkin the rest of the time. These results show that the change in prosody, i.e., having a prenominal adjective in the PP, does not affect children interpretation of that PP.

4.4.3 Experiment VI

The second factor we decided to control for has to do with the possibility that the two changes introduced in our experiment IV (*phrase-and-then-display*, color adjective) would improve children's performance even in situation in which a processing difficulty is expected.[42] If this were the case, the better performance of children we obtained would just show that children are capable of modifier interpretations when the necessary help is provided, (again) independently from the specific context used. However, our purpose here is also to show that the context matters and that children pay attention to referential cues in interpreting temporarily ambiguous sentences. To rule out the possibility that the two

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[41] The children who participated in Experiment V did not participate to Experiment I ,II, III or IV.
[42] In addition the experiment will also provide evidence regarding the role of prosody, just as Experiment V.

maneuvers we employed simply increased children's ability to access modifier interpretations, we conducted an experiment using the same two maneuvers in the 1-Referent Context. The 1-Referent Context, in fact, is context in which a garden path effect is expected. In fact, as we introduced in chapter II the presence of a single frog in the context, should lead children (but also adults,) to garden path when asked to act out an instruction containing the verb *put* followed by two PPs. For this reason, we chose to employ this context to evaluate the effect of the changes introduced in Experiment IV, which significantly improved children's correct actions (from 39% to 89%).

To illustrate, one trial was about one frog and one chick, both of which were on a napkin (one red, one blue), and there was an empty, red napkin (see Figure 4)[43]. After children were introduced to the lay-out, they were asked to turn away. While they could not see the display, they were given a verbal instruction, which contained a temporary ambiguity, as in (8). Having heard the entire sentence, children were allowed to turn back to the scene again and to comply with the instruction.[44] It is important to notice that the use of a color adjective in the sentence (the PP *on the red napkin*) does not add any relevant information in the present scenario since there is only one frog in the context.

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[43] Notice that the fact that the other animal (i.e., the chick) is also on a napkin does not constitute a problem since the referent for the NP *the frog* could be identified immediately given the presence of a single frog in the context.

[44] As the reader could see, the procedures were exactly the same as the ones for experiment IV.
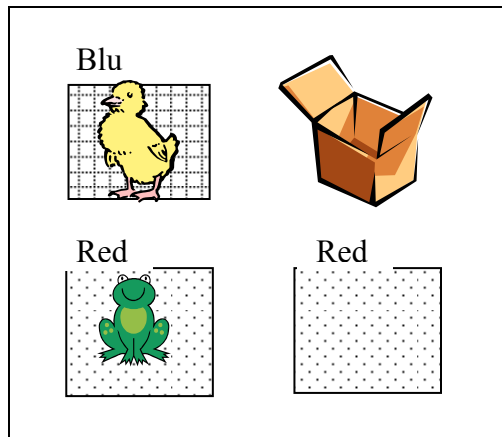
Figure 4: the one-color-referent context

(8)   Put the frog on the red napkin into the box.

As we have seen (Trueswell et al., 1999), children were found to experience garden path effects in responding to instructions like *Put the frog on the napkin into the box* in the 1-Referent Context in previous studies. In particular, children moved the only frog from the napkin it was on onto the other napkin (60% of the times) and then (eventually) into the box.[45] If the changes introduced in Experiment IV increased children's general ability to interpret PPs as modifiers, we would expect a significant improvement in children's behavior, i.e., more correct actions, in the one-color-referent context exemplified in Figure 4. To the

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[45] Although adults almost never produced an incorrect series of action, show nevertheless signs of being led down the garden path in their looking paradigm. Adults consistently looked at the empty napkin immediately after hearing the PP 'on the napkin', thus showing that a destination interpretation for that PP was entertained.

119

contrary, if the changes introduced in Experiment IV improved children's performance to interpret PP as modifier relatively to that particular context—the 2-Referent Context--we would expect children to be led down the garden path in the present experiment to (more or less) the same extent, as they had been in previous research.

We interviewed 12 children (age from 3;05 to 5;04; mean age 4;10).[46] Each child was presented with 4 target trials, four fillers and one warm-up. All and only the target trials were instructions containing the verb *put* followed by the preposition *on*, as illustrated in (8) above. As predicted, children manifested the signs of having been led down a garden path; namely, they moved the frog onto the empty napkin and then into the box, on 45% of the trials (22/48)[47]. Children keep accessing the VP interpretation of the first PP *on the napkin*.

The findings of Experiment V thus suggest that the mere presence of an adjective and the *phrase-and-then-display* mode introduced in Experiment IV do not facilitate children's interpretation of the initial prepositional phrase as a modifier. If that was true, children would have performed as successfully in the 1-Referent Context as in the 2-Referent Context. However one clarification is in place.

We hypothesized based on previous evidence that children's incorrect actions might be due to their eagerness to perform plans on the fly, even before

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[46] The children who participated in Experiment V did not participate to Experiment I , II, III or IV.
[47] Trueswell et al. 1999 reported roughly 60% incorrect actions.

the entire sentence has been uttered. That is, when given an instruction, children tend to assemble (and sometimes to execute) a response plan as the instruction unfolds over time. We have also seen how the *phrase-and-display* maneuver prevents children from forming early response plans with many linguistics constructions as well as with sentences like *Put the frog on the napkin into the box*. In fact, withdrawing the experimental setting from children while the sentence is being uttered makes it more difficult to plan a response in advance as well as start executing it. Given this explanation, one might wonder why children kept performing the wrong series of actions in the 1-Referent Context when the *phrase-and-then-display* maneuver is employed. In this situation in fact children are obliged to listen to the entire sentence before they are allowed to watch the experimental setting again and act-out the instruction. The question is even more interesting if we consider that in the 1-Referent Context adults too are led down the garden path: adults look at the empty napkin immediately after the occurrence of the PP *on the napkin*, and this was interpreted by Trueswell et al (1999) as a sign that they were considering the VP-attachment interpretation. However, the garden path is resolved by the time the second PP *into the box* occurs. Again, it is apparent that for children the occurrence of the second PP is not crucial as for adults: children entertain the VP-attachment interpretation even when the early execution of a response is inhibited by the *phrase-and-then-display* maneuver, which 'force' them to hear the entire sentence before being able to act-out it out.

We think the argument is well taken and raises an interesting concern. In fact, it assumes that in the *phrase-and-then-display* mode, children interpret the target sentence *off*-line rather then *on*-line. This hypothesis, however, ignores the fact that children are allowed to look at the scene before they are asked to turn away or close their eyes. In fact the scene is initially introduced to children to make sure they know the names of the objects being used. This means that children tested in the 1-Referent Context know that there is only one frog and, as a consequence, when hearing the instruction *Put the frog ...* they also start to interpret the sentence having that frog in mind. Under these circumstances, children obey to the Theta Assignment Principle thus entertaining the VP-attachment once the PP *on the napkin* is uttered. No other option is made available by the context. This results in a garden-path: an interpretation that needs to be revised. Children are not able to reanalyze whatever interpretation they pick at first. As we said this is one conclusion offered by Trueswell et al. (1999) that we feel confident in accepting. Thus, children are stuck with an interpretation that they cannot revise and perform the wrong series of actions. By contrast, let us recall what happened in the 2-Referent Context where the two frogs are both on a napkin but of a different color. Again, in the *phrase-and-then-display* mode, children are allowed to watch the scene before turning away from it. Here, however, both frogs could serve as the referent for the NP *the frog* when children are presented with the target instruction. Things are even worsen because both the frogs are on a napkin

already so a straightforward pragmatic inference of the type illustrated in the previous chapter will not help children either.[48] As a consequence, children relied on the linguistic material to help them in identifying the intended frog, they accessed the NP-interpretation of the PP *on the (red) napkin* and performed the correct action. Thus children do not attach the PP *on the (red) napkin* to the verb phrase. Rather they use the linguistic information in order to select NP-attachment. On this view, the maneuvers that lead to children's adult behavior in Experiment V do not improve children's ability to revise an incorrect interpretation. If this was the case, one would also observe improved behavior in the 1-Referent Context, contrary to fact. Rather, the maneuvers that lead to children's adult behavior in Experiment V inhibit the initial VP attachment PP *on the (red) napkin* to the verb phrase, so that NP-attachment is a live option, an option that is ultimately preferred in compliance with the Principle of Referential success. Thus, a garden path arises in the 1-refernt context and children cannot recover from the initial interpretation. By contrast, in the 2-Referent Context children select the correct interpretation form the very beginning and do not need to recover from a wrong initial hypothesis.

This said, we can reach the following conclusion about Experiment IV: when the relevant pragmatic inference was blocked, and when premature

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[48] It is true that the two frogs are on napkins of different color so a pragmatic inference could is possible in principle. One possibility is that children would resort to that kind of inference if they were 'forced,' for example by incoming linguistic material, to interpret the initial PP.

execution of children's response plans was blocked, children demonstrated adherence to referentially based parsing principles. We interpret the findings as indicating children's generation of a structural analysis that conforms to the presupposition of uniqueness associated with the definite determiner, so long as they are prevented from immediately executing the response dictated by the VP-attachment preference.

4.5 Conclusions

Based on the findings of the experiment presented in the previous section, we feel confident in maintaining our default hypothesis. First, children and adults share all of the core properties of the performance system in which linguistic knowledge is embedded, as well as sharing knowledge of the linguistic principles themselves. We conclude, in particular, that children and adults both adhere to fundamental parsing principles that have been proposed in the literature: the Theta Assignment Principle and the Principle of Referential Success. The difference between children and adults is that the processing of linguistic input is less automatic for children than it is for adults.

Chapter V

5.1 Introduction

Much contemporary research on child language focuses on children's semantic

competence, especially children's understanding of quantifiers (see Philip, 1995;

Musolino, 1998). Recent studies demonstrate children's extensive knowledge of

the semantic properties of quantification, despite claims to the contrary in

previous research (e.g., Inhelder and Piaget, 1964; cf. Crain, Thornton, Boster,

Conway, Lillo-Martin and Woodams, 1996; Gualmini, 2003). Research on

children's use of determiners has followed a more conservative path. In particular,

no agreement has been reached about children's over-generation of the definite

determiner *the,* first documented by Maratsos (1976) and Karmiloff-Smith (1979).

Children's non-adult behavior has been attributed to a deficit in pragmatic

competence (e.g., Maratsos, 1976; Matthewson and Schaeffer, 2000) or to a

difference in children's lexical entry for the determiner *the* (Wexler, 2003).

Nevertheless, several linguistic properties that distinguish between the definite

and indefinite articles have not been investigated. In the previous chapters we will focus on the role of the context in selection of the appropriate referent of definite NPs. In this chapter, we will focus on a different property that distinguishes between the definite article *the* and the indefinite *a*. This property is the ambiguity of sentences containing the verb *to have*. The ambiguity is between a possession reading and a custodial reading (e.g., Iatridou, 1995, Belvin and den Dikken, 1997). Interestingly, this ambiguity arises only if the verb *to have* is followed by an indefinite article (e.g., *I have a car*). If a definite article follows the verb *to have*, however, only the custodial reading is available (e.g., *I have the car*). The chapter is organized as follows. First we will introduce the semantic properties of the definite determiner 'the' and we will highlight the differences with the indefinite determiner 'a'. In particular we will focus on the *presupposition of uniqueness* associated with the definite determiner. The discussion is also relevant for the previous chapters. Then, we will report the results of some experiments on children's use of the definite determiner which show children's overgeneration of the definite 'determiner'—namely the fact that children use the definite determiner in situations in which an indefinite determiner would be more appropriate. In so doing, we will also present some of the theories proposed in the literature to account for children's mistakes. At the end of the chapter we will illustrate the behavior of the definite and indefinite determiner in *have*-

constructions and we report a study designed to investigate whether children are sensitive to this subtle difference in constructions that contain the verb *to have*.

5.2 What is definiteness?

In many languages, a noun phrase may contain an element whose principal role is to indicate the definiteness or the indefiniteness of the noun itself. In English this element is a lexical item: definites take *the*, while indefinites take *a* in the singular. In the next section I will provide a brief overview of the semantics of definiteness, based on the discussion in Heim (1991).

5.2.1 Definite NPs

A classical analysis for definites dates back to Russell (1905). According to this analysis a sentence of the form *The φ is ψ* must be analyzed as follows:

(1)   a. There exists at least one x such that x is φ

       b. At most one x is φ

       c. Such x which is φ is ψ

Under this analysis, a sentence containing a definite NP is analyzed as an existential sentence which asserts the existence of a unique entity described by the noun which satisfies the property expressed by the predicate. In order for the sentence to be true, all the three conditions given in (1) must be met. A sentence like (2), for example, will be true only if there exists exactly one frog and that frog is sleeping.

(2)   The frog is sleeping.

According to the Russellian analysis, if the unique frog is not sleeping (thus violating (1)c) the sentence is false. If no frog exists (contra (1)b) or multiple frogs (contra (1)a) exist the sentence is also false.

This analysis, however, incurs into problems when the entity denoted by the definite NP does not exist, as in (3).

(3)   The King of France is bald.

Under the Russellian analysis (3) should be false since the king of France does not exist. However, speakers often judge such sentence as neither false nor true. Given the non-existence of the entity denoted by the definite NP, it is counterintuitive to evaluate whether the property predicated by the predicate holds

for such non-existing entity or not. The condition of existence as well as the condition of uniqueness are better viewed as prerequisites for assigning a truth value to a sentence containing a definite NP rather then part of the meaning of the sentence. Thus, if either (1)b or (1)c is violated the sentence cannot be assigned a truth value. This is roughly the solution proposed by Frege (1892) and the one assumed by the so-called Fregean analysis of definites. The standard Fregean analysis of the definite determiner assumes that the use of the definite determiner *presupposes* both the existence and the uniqueness of the entity described by the common noun with which the definite determiner is combined.

Let us clarify the notion of presupposition before illustrating the presuppositional (Fregean) account of definite determiners. Roughly, the idea is that a proposition p presupposes another proposition q, if the truth of q is taken for granted, treated as uncontroversial, in order for p to be uttered felicitously. In other words, the truth of the statement expressed by a presupposition is a necessary condition in order to assign a truth-value to any statement associated with that presupposition. Here is how Heim (1991) puts it:

(4)   Let p and q be (possible partial) propositions. Then q is a semantic presupposition of p iff q is true at every world-time pair where p is true or false.   (Heim 1991:8)

Presuppositions place constraints on the assignment of semantic values. To illustrate let us consider the sentence in (5):

(5)   Joan stopped smoking.

(6)   Joan used to smoke.

In a given context, the sentence in (5) could be true or false; regardless of its truth value, however, (5) presupposes the truth of (6). Now, if (5) is uttered in a situation in which it is known that (6) does not hold, the sentence in (5) could not be assigned a semantic value. The use of (5) in such circumstances will give rise to a *presupposition failure* and will be infelicitous.

This notion of presupposition has been extended to definites by the Fregean analysis of definites. The formal definition of the Fregean analysis in (7) is taken from Heim (1991).[49]

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[49] The index *i* refers to the situational context.

(7)   [the φ] ψ expresses that proposition which is:

      a. true at an index i, if there is exactly one at φ i, and it is ψ at i

      b. false at an index i, if there is exactly one φ at i, and it is not ψ at i

      c. truth-valueless at an index i, if there isn't exactly one φ at i.

(Heim 1991:9)

Let us consider again the sentence in (2) here reported as (8):

(8)   The frog is sleeping.

According to the definition in (7), this sentence is true if there exists a unique frog
and it is sleeping; it is false if there exists a unique frog and it is not sleeping.
However, (8) has no truth value if there exist no frog or there exist multiple frogs.

Before concluding this section on the semantic properties of the definite
determiner a clarification is in place. We have seen how the felicitous use of a
definite determiner presupposes the existence of a unique entity. Whereas the
presupposition of existence always seems to be satisfied in contexts in which a
definite is used felicitously, one can find many cases in which uniqueness does
not hold and thus cannot be taken for granted. For instance, one can use sentences
like (8) without that of only one frog exists in the whole world. This has been
accounted for in the literature by assuming that the domain of discourse with

respect to which we interpret a definite NP depends on the utterance situation and constitutes only a small subset of all existing entities.[50] In other cases, definite NPs are used in situations in which the uniquely identifying property has to be inferred. Consider (9), relative to the context depicted in Figure 1 (from Haddock, 1989):
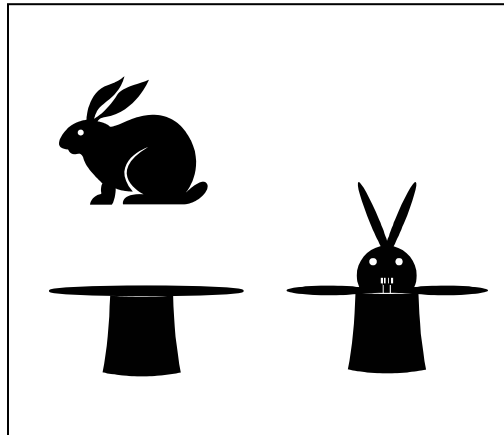
Figure 1: the rabbit in the hat

(9)   Now watch, I will remove the rabbit in the hat.

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[50] This objection is not peculiar to definite NP but it applies to any kind of quantified NP. The notion of contextual restriction is generally assumed for the interpretation of any quantified NP (see von Fintel, 1994).

Figure 1, contains two rabbits but the definite NP *the rabbit* successfully refers to the rabbit that is contained in the hat, presumably because to remove *x* from *y*, it must be the case that *x* is in y^{51}. Another example is provided by Lyons (1999):

(10)   *Context*:[Ann, fixing her motorbike, is examining a large nut. Behind her, just out of reach, are three spanners, two of them obviously far too small for the nut]
Pass me the spanner, will you?

Again, despite the presence of three spanners, the definite NP *the spanner* successfully refers to a unique salient spanner—the only one that can possibly fit the bill. These examples and many others (see Lyons, 1999) represent normal uses of the definite determiner. We can thus conclude that the presupposition of uniqueness is contextually restricted and only need to hold in the contextually relevant domain. Furthermore, as extensively illustrated in the previous chapters, the ultimate goal of the utterances (as well as the satisfaction of the relevant felicity conditions) might help in restricting the contextual domain such that a

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[51] The reader could see a clear connection with the experiments illustrated in the previous chapters with sentences like *Put the frog on the napkin into the box*.

uniquely salient entity, which serves as the referent of the definite NP, is singled

out (see also Chambers, Tanenhaus, Eberhard, Filip and Carlson 2002 for further

empirical evidence).

To recap, we assume with Heim (1991) that definite NPs presuppose the

existence and the uniqueness of the entity denoted by the noun they are combined

with. It remains to illustrate how indefinites NPs behave relatively to these

semantic properties.

5.2.2 Indefinites NPs

The standard analysis for the indefinite determiner *a*, since Frege and Russell,

treats that determiner in terms of the existential quantifier.[52] Thus a sentence like

(11) is true if there exists at least one frog that is sleeping and it will be false

otherwise (i.e., if none of the frogs in the discourse domain are sleeping or if there

are no frogs), as exemplified formally in (12):

(11)   A frog is sleeping.

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[52] We will not go into the issue of whether the lexical item introduces an existential quantifier or whether it simply introduces a variable which is then bound through existential closure (see Heim, 1982).

(12)   A sentence of the form [*a φ*] *ψ* expresses that proposition which is true if

there is at least one individual which is both *φ* and *ψ*, and false otherwise.

(Heim 1991:26)

It is relevant for our purposes to point out that the indefinite determiner *a*, as well

as indefinites in general, do not presuppose uniqueness or existence. A sentence

like (11), which contains an indefinite, is assigned a truth value even if more than

one frog is sleeping or if no frog exists. However, the definition in (12) raises an

interesting problem. Let us consider a sentence like (13) from (Heim, 1991):

(13)   I interviewed a father of the victim.

Given the existential interpretation of indefinites in (12), the sentence in (13)

should be felicitous. But it is not. The peculiarity of (13) derives from the fact that

it is inescapably uttered in a context in which the uniqueness of the entity denoted

by the NP can be taken for granted, since it is common knowledge that every

person has exactly one father. It seems that the indefinite determiner *a* cannot be

used in situations in which it is known that there exists a unique referent in the

discourse. To account for this observation, Heim (1991) placed a further

requirement on the interpretation of the indefinites determiners. This further

requirement makes it infelicitous to use the indefinite determiner *a* if the

presuppositions associated with the definite determiner are satisfied. Here is how Heim (1991) puts it:

(14)   In utterance situations where the presupposition for [*the* φ] ψ is already known to be satisfied, it is not permitted to utter [*a φ*] ψ.

(Heim, 1991;p.27)

This requirement comes from a pragmatic principle which has been called "Maximize Presuppositions".

(15)   *Maximize presupposition*

Make your contribution presuppose as much as possible.

(Heim, 1991;p.28)

Since, the definite determine *the* carries more presuppositions than the indefinite determiner *a* (and those presuppositions are satisfied in the context), it would be more appropriate to use *the* whenever the presuppositions are met.

It is time to take stock. In the previous paragraphs we have illustrated the semantic analysis for both the definite and the indefinite determiners. We have also highlighted the principles governing the use of these two determiners. In

particular while the definite determiner presupposes the existence and the uniqueness of the entity denoted by the noun it combines with, the indefinites determiner does not. On the other end, the indefinite determiner is often ruled out by the pragmatic principle of Maximize Presuppositions. Let us now turn to children's knowledge of the semantic properties of these determiners.

5.3 What children 'might' not know

Children's overuse of the definite determiner *the* (in situations where the use of the indefinite determiner *a* would be more appropriate) is a well attested phenomenon. To illustrate the phenomenon, we review some of the numerous studies on children's acquisition of determiners. One study is by Maratsos (1974). Maratsos (1974) used stories to elicit definite and indefinite articles from young children. Consider for example, the story dialogue in (16) from the Maratsos study (1976;p.440).

(16)   Once there was someone who wanted to have an animal. He went   out to a
        pond. He saw two bunches of animals, lots of frogs and lots of turtles; he

went up with his box, and he put one of them into his box. What did he put
in?

Adult response: a frog (or: a turtle)

Child's response: the frog (or: the turtle)

The child's use of the definite determiner in (16) yields a non-adult utterance. The
use of the definite determiner *the* requires that a uniquely salient object is
detectable in the domain of discourse, by both the hearer and the speaker. This
follows from the necessity to satisfy the presuppositions of existence and
uniqueness triggered by the definite article (Heim, 1991). If no 'unique' object
can be identified in the domain of discourse, then the indefinite article *a* must be
used instead. Thus, the child's choice of the definite determiner in the dialogue in
(16) is inappropriate unless some horse has been previously introduced in the
discourse, or is highly salient in the context.

A typical experiment reporting children's overuse of the definite
determiner was conducted by Karmiloff-Smith (1979) using an Elicited
Production task. In this task, children are encouraged, by features of the
experimental design, to produce sentences which contain the linguistic
construction under investigation. In the study by Karmiloff-Smith, French-
speaking children were presented with a girl-doll playroom which contained sets
of different toys, as in the scenario in (17), and were prompted by the

experimenter to ask the girl in the experimental context, manipulated by another experimenter, to lend them one of the objects – namely the object the experimenter was pointing at.[53] Importantly, the object the child was required to designate could have been a singleton (baby-bottle) or one of several identical objects (multicolored balls).

(17)   1 blue book, 3 multicolored balls and 1 baby bottle

Given the presupposition of uniqueness associated with the definite article, children should use the definite determiner *the*, if the object they are referring to is a singleton (i.e., "lend me the baby-bottle"), but the indefinite article *a* should be used if the object is just one of several identical objects (i.e., "lend me a ball"). The results show that children correctly used the definite article for the singleton set, but they incorrectly used the definite article also when 3 identical objects were present. The overuse of the definite article is attested in 3-year olds as well as 7-year olds. Only by age 9 did children in the Karmiloff-Smith study behave like adults.

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[53]. We refer the reader to the original study for details on the experimental setting.

5.3.1 Egocentricity view

A classical and widely accepted explanation for children's non-adult behavior is the Egocentricity view*,* proposed by Maratsos (1976).[54] According to the Egocentricity view, children's misuse of the definite determiner is not linguistic in nature. In particular, children fail to recognize that the object they have singled out as 'unique' in the context might not have been recognized as such by their listeners. This is how Maratsos puts it:

> "Our analyses have uncovered a developmental stage where
> egocentric definite responding is quite common. The children fail
> to take into account that even if they have established for
> themselves a particular boy or girl, or monkey or pig that does
> something, that referent is not yet unique specified for their
> listener, and must be introduced to the listener with an indefinite
> expression."   (Maratsos 1976:63)

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[54]. But see also Karmiloff-Smith (1979).

5.3.2 Maximality view

A more recent proposal by Wexler (2003) is linguistic in nature. This account attempts to explain children's non-adult use of the definite determiner by arguing that children do not have complete knowledge of the meaning of the definite determiner. The Maximality view claims that children have adult knowledge of the semantic properties of the indefinite determiner *a*, have the principle of Maximize Presupposition but, have a different lexical entry for the definite determiner, called by Wexler (2003) *theC*. The semantics of children's definite determiner *theC* is modeled directly on the definition of the Fregean analysis of *the* given in (7), but carries only the presupposition of existence as reported below.[55]

(18)   [the φ] ψ expresses that proposition which is:

a. true at an index *i*, if there is at least one φ at *i*, and it is ψ at *i*

b. false at an index *i*, if there is <u>at least</u> one φ at *i*, and it is not ψ at *i*

c. truth-valueless at an index *i*, if there isn't <u>any</u> φ at *i*.

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[55]Experimental evidence seems to suggest that children know the presupposition of existence associate with the definite determiner. Children, in fact, correctly use the indefinite determiner when no referents have been introduced in the context (cfr. Karmiloff-Smith, 1979). We will add to this evidence a the end of the chapter.

As shown above, the definite article for children only presupposes that there exists at least one entity denoted by the noun the determiner is combined with. Crucially, such entity does not have to be unique. What children do not know, then, is that the definite determiner *the* also carries a presupposition of uniqueness. Thus a sentence like (19) in a situation in which there are multiple sleeping frogs would be interpreted as the paraphrase in (20):

(19)   The <u>frog</u> is sleeping.

(20)   <u>One of the frogs</u> is sleeping.

In such a context the use of the definite determiner (*theC*) is preferred over the use of the indefinite determiner *a* because of the pragmatic rule of Maximize Presupposition, which is biasing towards the use of the item that carries more presuppositions. Since the definite *theC* carries the presupposition of existence, which is satisfied in the context, *theC* must be preferred.

To summarize, we have briefly illustrated children's non-adult use of definite and indefinite determiners and we have presented two proposals that attempt to account for such non-adult behavior. The last one of these proposals, the Maximality view by Wexler (2003), could in principle also explain children's difficulty with the interpretation of sentences like *Put the frog on the napkin into*

the box that we have extensively illustrated in the previous chapters. It is worth

considering Wexler's argument. In fact, if, as claimed by Wexler (2003), children

lack the knowledge that the definite determiner carries the presupposition of

uniqueness, the sentence in (21) will be interpreted by children as equivalent to

(22):

(21)   Put <u>the frog</u> on the napkin into the box.

(22)   Put <u>one of the frogs</u> on the napkin into the box.

In other words, children can pick one frog or the other indifferently. Since they do

not require the presence of a uniquely salient frog, children will not feel the need

to attach the PP *on the napkin* to the definite NP *the frog* in order to single out a

single frog. In this respect, Wexler's account, just like Trueswell et al's account,

assumes that children behave at chance in selecting the intended referent for the

definite NP, and thus it incurs in the same problems in explaining children's

actions. In fact, as we observed for Trueswell et al., Wexler's proposal does not

explain why children who selected (by chance) the right frog (the one already on a

napkin) performed the correct action (putting it directly into the box) instead of

moving it to the other napkin (as they did in the 1-Referent Context). Neither will

this proposal explain why whenever children selected the wrong frog, the frog off

143

the napkin, they performed the wrong action most of the time. We would like to

give Wexler's theory the best chance to succeed, however. A possible way out for

Wexler (2003) would be to assume, as we proposed, that children could have

made a pragmatic inference in order to select the intended referent. Even if

children's grammar does not require the presence of a uniquely salient frog in the

context, still a frog must be chosen in order to comply with the request of the

experimenter. Choosing the frog to move then could be achieved via the

pragmatic inference we argued for. In fact, the felicity conditions associated with

commands are still operative and likely to exert an effect. This line of reasoning

would also predict that children would keep performing the same pragmatic

inference --putting the frog that is not already on a napkin onto a napkin -- even if

an indefinite determiner –which does not carry a presupposition of uniqueness—is

used instead of a definite determiner.[56] As a consequence, the account proposed

by Wexler (2003) would explain why whenever children selected the wrong frog,

the frog off the napkin they performed the wrong action most of the time: these

are the children who performed a pragmatic inference in compliance with the

felicity conditions associated with commands. The question now is whether this

proposal will also be able to explain children's correct actions or not. Again, the

answer is *no*, if Wexler (2003) assumes, along with Trueswell et al. (1995), that

children picked the right frog by chance. However, the answer could be yes if

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[56] An experiment to test such a possibility with both children and adults is in progress.

Wexler (2003) assumes, as we do, that the children who have selected the right

frog did so for the right reason. In Wexler's terminology, those are children who

have developed the adult determiner system; they know that the definite

determiner carries the presupposition of uniqueness.

So far, it seems that we are unable to rule out the possibility that children's

difficulty in processing a sentence like *Put the frog on the napkin into the box* are

due to children's non adult semantic competence for the definite determiner. The

proposal advanced by Wexler (2003), however, could not explain why children

consistently selected the right frog in our own experiment. Interestingly,

children's correct performance could not be attributed on of the maneuvers

introduced, namely *phrase-and-then-display.* In fact, when the same maneuver

was introduced in the 1-Referent Context, children went back to commit the same

mistakes again.

From a more general point of view, we think the account proposed by

Wexler (2003) runs into an even more serious problem which needs to be taken

into consideration. As we have illustrated, Wexler (2003) claims that children

have a different semantics for the definite article, that is children lack the

principle of Uniqueness (or Maximality) which makes ungrammatical (or

infelicitous) the use of the definite determiner if more than one possible referents

are present in the context. If this is the case, then the prediction is that children

should always produce the definite article *the* in those cases in which the

presupposition of uniqueness is crucial[57] in determining which determiner, if a definite or an indefinite, must be used. However, this prediction is not borne out. Although children overuse the definite article in situations where an indefinite would be more appropriate, they do not do it all the time. In other words, the same child sometimes uses *a* and sometimes uses *the* in similar circumstances. Moreover, data from Maratsos (1976) show that at a previous stage children overuse the indefinite article *a* rather than the definite article *the*. Could the proposal be modified to account for those mistakes as well? For example, would the author assume that at an earlier stage children's interpretation of the definite article also lacks the presupposition of existence, and thus *a* and *the* are almost equivalent?

To recap, so far we have reported some experimental results showing that children commit mistakes in the use of determiners. We have also presented and discussed two different accounts that explain children's mistakes by appealing to what children might not know. The Egocentricity view (Maratsos, 1976) attribute children's mistakes to a gap in children's pragmatic competence, while the Maximality view (Wexler, 2003) attribute children's mistakes to a lack in children's linguistic competence. It is now time to redeem children. In what follows, we would like to investigate what children know about the determiner

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[57] It is important to restrict the relevant cases to only those in which the presupposition of uniqueness is involved because, as Maratsos (1976) and Karmiloff Smith (1979) experiments show, children have knowledge of the presupposition of existence. In fact, when the presupposition of existence is not satisfied, children correctly used the indefinite article *a*.

system, and in particular about the difference between the definite and the indefinite determiner. This constitutes the focus of the remaining of this chapter. We will return to these issues in the next chapter when we will present other empirical studies in which children's knowledge of the presupposition of uniqueness associated with the definite determiner turns out to be relevant.

5.4. What children do know

In this section we focus on children's competence of a different linguistic property related to the definite/indefinite distinction.

5.4.1 The semantic definiteness effect with 'have' constructions

An interesting distinction between definite and indefinite determiners in English has been observed since Milsark (1974; 1977). The observation is that existential *there*-sentences may contain an indefinite noun phrase following the copula, but definite NPs are ungrammatical in the same linguistic environment, as shown in examples (23) and (24). This restriction on the kind of NPs allowed in *there*-sentences is known as the Definiteness Effect.

(23)   There is a man.

(24)   * There is the man.

A similar constraint against definites is found in constructions with the verb *have*, on a particular reading. This is known as the 'semantic definiteness effect.' To illustrate, consider the sentences in (25) and (26).

(25)   John has a car.

(26)   John has the car.

While (25) can mean that John is the owner of a car, (26) does not mean that John is the owner of the specific car under discussion. Rather, the meaning of (26) can be paraphrased as *John has temporary custody of the car*. Following Iatridou (1995), we call this interpretation the *custodial* reading of *have*. To rephrase the point, an indefinite Noun Phrase, as in (25) may yield either a possession or a custodial interpretation, whereas a definite NP like (26) can only express a custodial meaning. The similarity between the two constraints against definites

led linguists to pursue a deconstructionist approach, according to which

(possessive) *have* is derived from *be*.[58]

The intuition offered by Iatridou (1995) is that *have* in possession

constructions requires an individual variable as its complement. Thus, the

possession reading of the verb *have* is possible with an indefinite NP, which

supplies an individual variable. By contrast, when the NP is definite, it cannot

provide an individual variable. This does not make the utterance ungrammatical.

Rather, *have* is interpreted on its custodial reading, where it selects an eventive

variable rather than an individual variable. Setting technical details aside, these

facts point to a distinction in the interpretation of sentences containing the verb

have which ultimately relate to the distinction between definite and indefinite

determiners. The question is whether children are sensitive to this distinction. To

address this question, we turn to the laboratory.

5.4.2 Experiment VII

This section presents the findings of an experiment designed to investigate

whether children distinguish between a possession and a custodial reading of the

verb *have* in sentences containing the definite determiner *the* and the indefinite

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[58]. Interestingly, in both type of constructions the constraint is against all strong determiners (in the sense of Milsark, 1974).

determiner *a.* The experimental technique is the Truth Value Judgment task (Crain and McKee, 1985; Crain and Thornton, 1998). In a Truth Value Judgment task, one experimenter acts out a short story in front of the child, using props and toys. A second experimenter manipulates a puppet, who watches the story with the child subject. At the end of the story, the puppet utters the target sentence. At this point, the child is asked to evaluate the target sentence as a description of the story she has just seen. The acceptance of the target sentence is interpreted as indicating that the child can access an interpretation that makes the target sentence true in the context under consideration. By contrast, the rejection of the target sentence is taken as evidence that the child's grammar does not license any interpretation that makes the sentence true in the context. In the present experiment, the story establishes a context in which a particular character is the owner of a given object but does not have the custody of that object at the time the target sentence is produced (i.e., at the completion of the story). Let us illustrate a typical trial:

(27)   This is a story about Grumpy. Grumpy owns two dogs and he would like
        to have them brushed. So Grumpy asks Tommy the Ranger, who knows a
        lot about animals, to brush his dogs. Unfortunately, Tommy has time to
        brush only one of Grumpy's dogs. Grumpy thinks for a little while then he
        decides which dog needs to be brushed and then goes away with the other

dog. Before leaving, however, Grumpy tells Tommy that he will be back in an hour to pick up his dog. Left alone, Tommy brushes Grumpy's dog and then waits for Grumpy to come back. While he is waiting, Winnie the Pooh comes by. He sees Tommy with the dog and says: "Hey Tommy, that's a really nice dog you have. Do you mind if I take him for a walk?" and Tommy replies: "Actually this is Grumpy's dog and he wanted me to take good care of him. But you can take him for a very short walk. But you have to bring the dog back before Grumpy comes." At this point, Winnie leaves with Grumpy's dog — the one that Tommy brushed.

Thirty children participated in the experiment. The children were divided into two groups. One group of fifteen children (age: 3;09 to 5;05 -mean age 4;09) was asked to evaluate a sentence that contains an indefinite determiner as in (28).

(28)   Grumpy has a dog that Tommy brushed.

Notice that the sentence in (28) is ambiguous. The string "has + a" has both a possession and a custodial reading. Under the possession reading, the sentence accurately describes the final outcome of the story. By contrast, under the custodial reading, the sentence in (28) is false; Grumpy is the owner of the dog that Tommy brushed, but he doesn't have custody of that dog at the time the

target sentence is uttered. Under the assumption that, all things being equal, a cooperative subject will attempt to access an interpretation that makes the sentence true, in compliance with the Maxim of Charity (Davidson, 1984; Grice, 1975), we expect children to accept the sentence in (28).

The second group of fifteen children (age 3;10 to 5;08 - mean age 4;10) was asked to evaluate sentence (29). This sentence differs from (28) only in that the indefinite determiner *a* has been replaced with the definite determiner *the*.

(29)   Grumpy has the dog that Tommy brushed.

Given the presence of the definite article, however, this sentence is not an accurate description of the final outcome of the story. As noted earlier, the string 'have + the' does not license a possession interpretation, but this is the only interpretation that would make the sentence true. Thus, if children know that a sentence like (29) only licenses a custodial interpretation, they should reject the sentence based on the fact that Grumpy does not have custody of the dog that Tommy brushed at the time the sentence is uttered. By contrast, if children treat the definite determiner on a par with the indefinite determiner in the context under consideration (for the verb *have*), ignoring the difference in interpretation yielded by the two determiners, they should accept (29).

Here are the findings. Children accepted sentences like (28) in 53 out of 60 trials (88%), whereas they accepted sentences like (29) only in 6 out of 60 trials (10%). These findings suggest that children know the properties of the string 'have + a/the' and are sensitive to the difference between the two determiners.

Before drawing any conclusions, however, one point of clarification is needed. A possible explanation of children's results would be that children always assign a custodial interpretation to the definite determiner *the*, regardless of the linguistic construction in which these determiners occur.

To address this concern, we tested another group of children in a control condition. The third group of fifteen children (from 3;06 to 5;08 - mean age 4;08) was asked to evaluate sentences like (30), in which the string 'have + the' has been replaced with 'own + the'. The task and the story were the same as above in all important respects.

(30)   Grumpy owns the dog that Tommy brushed.

The sentence in (30) truthfully describes the outcome of the story. Children were therefore expected to accept (30) relative to the context. It is important to notice that the sentence (30) contains the definite determiner *the,* as does sentence (29). So, if children accessed the possession reading of (30), thereby accepting the sentence, it would mean that children can only assign a custodial reading to the

definite determiner *the*. Rather, they are sensitive the properties of the string 'have + the.'

The results show that this is indeed the case. Children accepted the sentence in (30) 58 times out of 60 trials (96%), on the grounds that Grumpy had permanent possession of the dog that Tommy brushed.

We conclude that children know a theoretically motivated distinction between the definite and indefinite articles. Moreover, our findings show that 4-year-olds know the restriction against definites as objects of *have* on its possession reading.

5.5 Interim conclusions

We think that the importance of the experiment we presented is twofold. First, the findings show children's indirect knowledge of the definiteness effect. Second, the findings provide evidence in favor of children's knowledge of presuppositional force. Let see each of them in turn.

As we illustrated before, what is being referred to as the Definiteness Effect since Milsark (1974;1977) is the restriction exhibited by existential

constructions, i.e., *there*-sentences, against strong determiners[59] as for example,

the, *every*, *most*. From the point of view of language acquisition, it would be

interesting to see whether children's grammar reflects this linguistic property of

existential sentences. One source of evidence could come from the analysis of

children's spontaneous data. This kind of evidence presents some shortcomings

though. First, one could have to draw a conclusion on a negative result, that is

from the absence in children's spontaneous speech of existential sentences

containing strong determiners (see Becker, 2000). Second, as pointed out by

Becker (2000), in coding children's spontaneous existential utterances it is

difficult to tell whether utterances containing the expletive *there* are actually

existential expressions or deictic (locative) expressions, since both existential and

deictic (locative) expressions have the same form. Interestingly, one of the

properties that differentiate between the two uses of *there*-sentences is that deictic

expressions may have a definite post-copular determiner (e.g. *There/here is*

John/the car), while existentials may not.

As a consequence, even the few cases in which a definite determiner

occurs in a *there*-sentences, will not constitute clear evidence against children's

knowledge of the Definiteness Effect. This leads us to the role played by the

semantic definiteness effect observed in *have*-constructions. In fact, these

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[59] The partition of determiners into two classes, weak and strong, is again due to Milsark (1974; 1977). The classification is descriptive and it is based on the possibility for a determiner to occur in existential *there-sentences*: weak determiners can, while strong determiners cannot.

constructions are grammatical regardless of which determiner follow the verb

have. The type of determiner used in the *have*-sentence only dictates the possible

readings of that sentence: i.e., custodial or both custodial and possession. Thus, by

assuming that the Definiteness Effect exhibited by *there*-sentences and the

semantic Definiteness Effect displayed by *have*-constructions are two different

manifestations of the same linguistic phenomena we can conclude children's

knowledge of that linguistic property.

This said, we can now turn to the second reason why we think our study is

relevant. As we just briefly mentioned (cfr. Ft.59) the classification of determiners

in strong and weak was introduced by Milsark (1974;1977). The defining

characteristic is that only the latter can occur in existential *there*-sentences. About

this distinction, Heim (1982) observed that the defining characteristic of strong

determiners is the presupposition of existence that they carry. It is in fact this

presupposition of existence that makes strong determiners incompatible with the

existential *there* constructions (see also, among the others, Barwise and Cooper

1981, Reuland 1983; 1985, and Zucchi, 1995): existentials constructions assert

what strong determiners presuppose, and the pragmatic clash created when they

are combined results in the ungrammaticality of such sentences.[60] As a

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[60] There are other theories that try to account for the definiteness effect, some of those from a pure syntactic point of view. However, the semantic analyses generally appeal to the presupposition of existence of the strong quantifiers and explain both data from other languages which do not exhibit the syntactic definiteness effect, (i.e., Italian) and data from locative *there*-sentences (in strong quantifiers can occur).

consequence, children's knowledge of the (semantic) definiteness effect, is also

suggestive of their knowledge of the presuppositional force of a strong determiner

as *the*.[61] This is an important result in light of recent theories according to which

children are unable to represent the presuppositional force of strong quantifiers,

thus treating them as weak quantifiers. (Geurts, 2002 – Drozd and van Loesborek,

1998). Clearly the fact that children fail to map the presuppositional force of all

strong determiners, thus interpreting them as they were weak, cannot be the case

otherwise children would have ignored the difference in interpretation in *have*-

constructions when a weak or a strong determiner occurs. The claim that children

might have problems in recognizing the presuppositional force of strong

determiners has been proposed in order to explain children's non-adult

interpretation of the universal quantifier *ever*.[62] A way to test this hypothesis

would be to conduct a different version of the experiment presented above, one in

which the definite determiner *the* is replaced with the universal quantifier *every*.

We report about this study in the next section.

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[61] Again, here we are assuming that, given the parallelism between *there*-sentences and *have*-constructions as hypothesized by Iatridou (1995), the restriction against strong determiners is motivated by the same principles.

[62] But see Crain et al. 1996, Meroni et al. 2000V and Meroni 2002 for an alternative explanation of children's mistakes. In particular, these authors contend that children have a full adultlike understanding of sentences containing *every* and attribute their mistake to an experimental artifacts. Evidence in favor of this hypothesis comes form a series of experiments which demonstrate: 1) children adultlike interpretations of sentences containing *every* in felicitous situations and 2) childlike behavior from adults in infelicitous situations, the same situations responsible for children errors.

5.5.1 Experiment VIII

This section presents the findings of an experiment designed to investigate whether children distinguish between a possession and a custodial reading of the verb *have* in sentences containing the universal quantifier *every*. Children were tested using the Truth Value Judgment task and were asked to evaluate sentences like (31);

(31)   Tigger has every rooster that the farmer fed.

The story, against which to evaluate (31) set up a context in which Tigger is the owner of the roosters that have been fed by the farmer but he does not have custody of them when the target sentence is uttered. In fact, a third character, Gonzo, has custody of them. So, in our story the possession reading makes the sentence true, because Tigger is indeed the owner of the roosters; on the contrary, the custodial reading makes the sentence false: Gonzo, and not Tigger, has custody of every rooster fed by the farmer. Let us recall, that *every* should behave as *the* in *have*-constructions. Both determiners belong to the class of strong determiners, which are also referred to as presuppositional determiners, and are subject to the definiteness effect. It follows that a string like *have + every* can only receive a custodial interpretation. The prediction will then be that if children

interpret a strong quantifier like *every* as weak they should access the possession

reading thus accepting the sentence.[63] By contrast, if children know and apply the

distinction between strong and week determiners, they should access only the

custodial reading, thus rejecting the target sentence.[64] Ten children (age from 3;0

to 5;1, mean age: 4;4;) have been tested in this experiment. Every child was

presented with four target trials and four filler trials to balance *yes* and *no*

responses. The preliminary results show that children consistently reject the target

sentence (33 times out of 39 trials, 85%) on the grounds that that Tigger doesn't

have custody of every rooster.[65] We take this result as evidence that children

recognize the presuppositional force of the universal quantifier *every*.

6. Conclusion

In the present chapter, we examined children's use and interpretation of definite and indefinite

determiners. First, we reviewed children's non-adult use of the definite article *the* in contexts in

which adults would use the indefinite *a*, and we illustrated two accounts of children's

overgeneration of the definite determiner *the*. After reviewing what children do not know about

the determiner system, we focused on what children do know. We took *have*-constructions as a

case study. These constructions in fact receive a different interpretation—custodial or both

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[63] In analogy with children's interpretation of the string '*have+a*', reported in Experiment VII.
[64] In analogy with children's interpretation of the string '*have+the*' reported in Experiment VII.
[65] The total number of trials do not amount to 40 because one child did not answer to one trial.

possession and custodial-- depending on whether the NP in post-verbal position is definite or indefinite. This phenomenon has been know as the semantic counterpart of the Definiteness Effect of existential *there*-sentences since the class of determiners involved—the class of strong determiner—is the same for both linguistic constructions. We reported the results of a series of experiments designed to investigate children's competence of the (semantic) Definiteness Effect. In so doing, we compared the string *have+a*, for which both the custodial and the possession readings are possible, with the string *have+the*, in which only the custodial reading is allowed. The findings show that children are sensitive to the distinction between the definite and the indefinite determiner and are also aware of the (semantic) Definiteness Effect. Drawing upon the similarities between *there*-sentences and *have*-constructions we extended our study to another determiner belonging to the class of the strong determiners. As we illustrated, in fact, strong determiners as opposed to weak determiners, are subject to the Definiteness Effect. The universal quantifier *every* fits our purposes and also allows us to evaluate a recent proposal by Geurts (2002) which claims that children represent *every* as a weak quantifier. The result of our experiment shows that this cannot be the case. Children treat *every* in analogy with the strong determiner *the*, and in contrast with a weak quantifier like *a*.

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