Reference Processes in Intensional Contexts

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Abstract

This paper presents two reading experiments investigating reference processes in intensional contexts. Both studies employ sentence pairs containing a definite NP whose potential antecedent is embedded in an intensional context, where definite anaphora is not supported. Previous work on this topic has shown that the interpretation of such sentences elicit a cost in terms of reading times, because readers undertake inferential or revision processes to derive a coherent text representation. The results of the experiments, however, do not support these accounts. Instead, they are consistent with a new theoretical development based on the notion of non-actuality implicature (Frazier 2008).

1 Introduction

It is well known in natural language semantics that intensional verbs like *want, need* and *look for* give rise to contexts in which indefinite noun phrases (NPs) can receive two readings. For example, on one reading of (1a), Mary wants a horse for her birthday, but no particular one, on the other reading, there is a certain horse such that Mary wants it for her birthday:

(1) a. Mary wants a horse for her birthday.
b. John is looking for a unicorn.

The two readings are usually referred to as unspecific and specific, respectively. On unspecific readings, indefinite NPs do not presuppose the existence of their referent, giving rise to what is often called a lack of existential import. For example, a sentence like (1b) may well be true although unicorns do not exist[1]. As a

[1] Another major property of intensional verbs is that substitution of coreferential terms in the complement may not preserve the truth value of the original sentence (for an overview of properties of intensional (transitive) verbs, see Forbes, 2004). In the remainder of the paper, I will refer to verb phrase constructions headed by an intensional verb as intensional contexts.

Arndt Riester & Torgrim Solstad (eds.)
Proceedings of Sinn und Bedeutung 13, University of Stuttgart, 2009

consequence, complements of intensional verbs generally do not support definite anaphora (Karttunen, 1976; Moltmann, 1997), as seen in (2a) as opposed to (2b) (here '#' means 'infelicitous on the unspecific reading of the indefinite'):

(2) a. Mary wanted a horse for her birthday. # The horse / it was white and had a golden mane.
b. Mary got a horse for her birthday. The horse / it was white and had a golden mane.

Although the theoretical investigation on intensionality has a rich tradition, going back at least to Frege (1892) and Quine (1956), the topic has not figured prominently in psycholinguistics. Intensionality has entered this field of research as a 'tool' to set up contexts that do not support definite anaphora, as in (2a), in order to investigate whether modal information elicits empirical effects with regard to discourse processing (Dwivedi, Phillips, Lague-Beauvais, & Baum, 2005) and the nature of the inferential processes that readers undertake to achieve coherent text representations (Haviland & Clark, 1974). The empirical evidence collected in these studies suggests that intensionality affects discourse processing. However, the nature of the mechanisms that underlie the online processing of sentence pairs such as (2a) is still an open question.

In the present paper I present two experimental studies focusing on the interpretation of definite NPs in intensional contexts. I argue that the results of these experiments do not support previous accounts of intensionality effects in discourse processing. Instead, they are predicted by a new theoretical development (Frazier, 2008) based on the notions of accommodation and non-actuality implicature.

The paper is organized as follows. In the following section I provide a brief overview and a critical assessment of the relevant psycholinguistic literature. Section 3 presents the two experimental studies that have been carried out. In Section 4, the experimental results are discussed with respect to previous models of discourse comprehension and Frazier's (2008) notion of non-actuality implicature. Section 5 provides a brief summary and a conclusion.

2 Background

As mentioned above, intensionality is not a core topic in psycholinguistics. However, intensional verbs have been exploited to test theories of reference processes during discourse comprehension. Specifically, sentence pairs such as (2a) as opposed as (2b) have been used to investigate anaphoric bridging processes (Haviland & Clark, 1974, Experiment 2) and theories of modal subordination (Dwivedi et al., 2005). These studies were motivated by the basic assumption in discourse processes research that, while processing a text, the reader's goal is to build a coherent representation in which incoming information is related to earlier portions of text via anaphoric or inferential processes (e.g. van Dijk & Kintsch, 1983; Kintsch & van Dijk, 1978; Gerrig & McKoon, 1998; Sanford & Garrod, 1981; Wolf, Magliano, & Larsen, 2005). A

consequence of this assumption is that if readers are not initially successful in identifying an antecedent for an anaphoric expression, they resort to alternate strategies for establishing coherence.

In the two-sentence discourses illustrated in (2), both the definite NP *the horse*- which normally presupposes the existence of a referent (Russell, 1905; Strawson, 1950) and signals that it is already given or familiar to the interlocutor (Heim, 1982)- and the pronoun *it* require an antecedent to be interpreted. While in (2b) the antecedent is already given in the context sentence, in (2a) it must be accommodated as a new discourse entity, provided that the indefinite in the context sentence is interpreted as unspecific. As a consequence, readers must undertake additional processing in order to build a coherent text representation. In support of this prediction, the experimental studies reported in Haviland & Clark (1974) and Dwivedi et al. (2005) consistently showed a processing cost associated with sentences containing definites whose potential antecedents are embedded in an intensional rather than an extensional context. The two studies, however, offer two different accounts of their findings and, more important, both are problematic from the methodological point of view.

To begin, Haviland & Clark (1974; Experiment 2) used intensional contexts to control word repetition effects in the investigation of inferential bridging processes. Specifically, in their first experiment, they showed that a sentence like *The beer was warm* is more difficult to process when it follows a context sentence like *We checked the picnic supplies* than *We got some beer out of the trunk* because readers need time to make a bridging inference which relates *beer* to *picnic supplies*, in order to generate a coherent text representation. Although the reading time difference could be indicative of bridging processes, there was an obvious alternative explanation of their finding: the repetition of the word *beer* in the easier condition might have facilitated the processing of the target sentence, causing faster reading times than in the harder, bridging condition. To control word repetition effects, Haviland & Clark (Experiment 2) tested sentence pairs like those in (3), where a repetition of the critical word was obtained in both conditions but, crucially, definite anaphora was supported only in (3a, b):

(3) a. Ed was given *an alligator* for his birthday.
a'. Ed wanted *an alligator* for his birthday.
b. The alligator was his favourite present.

Haviland & Clark hypothesized that in order to establish a coherent representation of the sentence pair (3a', b), the comprehender needs to infer that *Ed actually got an alligator for his birthday, and that alligator was his favourite present* (Haviland & Clark, 1974, p. 516). The bridging process, here, consists in accommodating a new discourse referent for the definite NP and interpreting it as standing for the alligator that Ed got for his birthday. The results of the experiment supported this hypothesis showing longer reading time for (3b) following (3a') than (3a). This finding, however, does not necessarily prove that intensional contexts affect discourse processing. The experimental paradigm used in the study does not enable us to assess whether the costly process is the accommodation of a new discourse referent

due to the anaphorically inaccessible context, as claimed by Haviland & Clark, or an otherwise motivated bridging inference. Consider the sentence pair given in (4):

(4) The day of his birthday, Ed saw an alligator at the pet shop.
The alligator was his favourite present.

Here, nothing prevents the definite NP to be interpreted as coreferentially linked to the indefinite in the context sentence. However, a bridging inference is required to coherently connect the event of seeing an alligator and the information that that alligator was Ed's favourite present (at least, it is necessary to infer that someone gave Ed the alligator as a birthday present!).

More important, Haviland & Clark instructed participants in the experiment to "[…] be sure to read and pay attention to the first sentence in each pair since it would be related to the second. But, [*they were*] told, it was the second sentence that [*they*] were interested in […]" (p. 515). These instructions might have induced participants to actively find a detailed bridge between the two sentences in each pair, producing reading time differences as a function of task demands rather than the experimental manipulation.

Finally, Haviland & Clark did not take into consideration that, upon encountering the definite NP in the target sentence, participants might have been biased to adopt a specific interpretation of the indefinite in the context sentence. When computed, a specific reading of the indefinite supports definite anaphora and makes the discourse coherent. The latter hypothesis has been investigated in an Event Related Potential (ERP) study by Dwivedi et al. (2005).

The experiment tested materials like (5):

(5) a. John is writing a novel. It ends quite abruptly
b. John is considering writing a novel. #It ends quite abruptly.

In (5a), the indefinite *a novel* can act as antecedent for the pronoun in the target sentence. In (5b), by contrast, the intensional verb *consider* produces an intensional context where anaphora resolution is blocked. The results of the experiment showed a P600-like effect, with a frontal distribution, elicited by the verb in the second sentence (*ends*) of (5b) compared to (5a), suggesting a revision in discourse structure. The revision process was explained within the theory of modal subordination outlined in Roberts (1987, 1989, 1996). Robert's theory builds on Kamp's (1981) Discourse Representation Theory in which information that is conveyed in discourse is structurally represented in a Discourse Representation Structure (see also Kamp & Ryle, 1993). In Robert's theory, elements that are under the scope of modal or intensional operators are represented in subordinate structures and are not accessible for anaphoric reference from entities appearing in the main structure, where factual information is represented. The P600-like effect was thus interpreted as a structural revision of the context sentence in which the processor computes a specific interpretation of the indefinite NP in order to authorize anaphora resolution. Such specific interpretation comes about by accommodating the discourse referent

associated to the indefinite into the main discourse structure, where it becomes accessible to the pronoun. The interpretation of (5b)- as achieved through this structural revision process- would be paraphrasable as *John is considering writing a certain novel that he has in mind and it ends quite abruptly.*

Although Dwivedi et al.'s study used pronouns instead of full definite NPs, their results suggest that in Haviland & Clark's Experiment 2 participants might have spent additional time in revising the context sentence in order to provide the definite NP with a structurally accessible antecedent. However, a word of caution is in order. The results reported in Dwivedi et al. may be questionable at the methodological level. The analysis at the verb position, in fact, used as baseline correction a time window where the authors had shown a negative ERP effect starting at about 500 ms after the onset of the pronoun in the intensional condition. This may have produced a seeming long lasting positivity after the verb at similar scalp locations.[2]

To summarize, the experimental investigation on reference processes in intensional contexts has produced controversial results. Several questions are still open and need further investigation. For example, even supposing that reference processes in intensional contexts elicit a cost in terms of reading times, it would be useful to investigate the locus and time-course of such cost. A clear prediction in this respect can be made if we consider that anaphora support is possible when the anaphor occurs in the context of modal subordination (Roberts, 1996; Moltmann, 1997), as in (6):

(6) Mary wants a horse for her birthday. It *must* be white and have a golden mane.

The consequence for a theory of processing is that, upon encountering the pronoun, the processor has still the possibility to build a coherent representation of a sentence like (6). It is at the verb position of the second sentence that the felicity of the discourse can be judged and, if need be, a repair strategy undertaken. Thus, we might expect a cost to be localized around the verb region of the second sentence of (3a', b). This prediction has been tested in the following studies.

3 Two experimental studies on intensionality in discourse processing

The two experimental studies reported in this section build on previous research to investigate how intensional contexts affect discourse processing. Before presenting the experimental investigation, a few remarks are in order with respect to the experimental methodologies that have been used. The first experiment employed the self-paced reading method, which is one of the most commonly adopted method to investigate sentence and discourse comprehension. In this method, items can be presented

[2] In ERP experiments, it is crucial to ensure that an effect is not already present in the signal before the target stimulus was actually presented. If this was the case, it would indicate that the signal is contaminated by a confound that is not stimulus-related.

sentence-by-sentence, phrase-by-phrase, or word-by-word. Experiment 1 used a non cumulative phrase-by-phrase presentation, which is also called moving window technique. In this technique, segments appear first in the form of a set of dashes, with each dash corresponding to a character and with spaces between dashes corresponding to spaces between words. With each press of a key, a segment is revealed on the screen and, with each subsequent press, the subsequent segment appears and the previous one disappears. Thus, participants are able to control the rate of presentations of the materials, and reading times are recorded between each press of the key. The moving window technique is informative about possible processing difficulties associated with a fragment: the greater the processing difficulty and the longer the reading times. Experiment 1 used this technique to assess whether the cost previously found by Haviland & Clark (1974)- a cost detected by the time taken to read the *whole* target sentence- could be replicated and, if so, at which phrase of the sentence it would be revealed.

Experiment 2 used the eye-tracking methodology, which allows participants to read in a more naturalistic way and to look back at earlier portions of the text. By monitoring eye-movements during reading, this technique measures fixation times on critical words or regions of a text as well as regressive movements towards previous regions. A lot of factors, both lexical (e.g., length and frequency of a word) and contextual (e.g., predictability and ease of integration of a word into a sentence or discourse) have been found to influence fixation times during reading (Just & Carpenter, 1980; McConkie, Hogaboam, Wolverton, Zola, & Lucas, 1979; Rayner, Sereno, Morris, Schmauder, & Clifton, 1989; see Rayner, 1998 for an overview). Interestingly, there is abundant evidence that fixation time in the region of an anaphoric expression varies as a function of how it is easy to make the link between the anaphor and its antecedent (e.g., Ehrlich & Rayner, 1983; Albrecht & Clifton, 1998; Garrod, Freudenthal, & Boyle, 1994; Kennison & Gordon, 1998; Paterson, Sanford, Moxey, & Dawydiak, 1998).

To determine the existence, locus, and time-course of processing difficulties, it is first necessary to define the region of interest and then analysing the temporal processing associated with that region. There are several measures that can be used as an index of processing time. In Experiment 2, the following measures have been considered: first-pass time, which is defined as the sum of all fixations beginning with the reader's first fixation in a region until the reader's gaze leaves the region; total time, which is the sum of all the fixations made in a region, including the time spent in the region after regressing back to it; second-pass time, which is the time spent in a region after leaving it either to the left or to the right. Notice that reference processes are assumed to be captured by early processing measures, like first-pass times, while higher-level integration processes, like bridging inferences, are more likely to be detected by measures of later processes, like second-pass or total reading time (Sturt, 2003).

3.1 Experiment 1

3.1.1 Method and materials

Experiment 1 was designed to replicate the effect obtained by Haviland & Clark (1974; Experiment 2) using different materials in a different language (Italian)[3]. The experiment tested sentence pairs such as those illustrated in (7)[4]:

Context

(7) a. Il cuoco comprò/ una pentola nuova/ per il suo ristorante.
The chef bought/ a pot new/ for the his restaurant.
'The chef bought a new pot for his restaurant.'

a'. Il cuoco voleva/ una pentola nuova/ per il suo ristorante.
The chef wanted/ a pot new/ for the his restaurant.
'The chef wanted a new pot for his restaurant.'

Target

b. La pentola/ costò/ parecchio.
The pot/ cost/ (PAST) a lot.

The first sentence of each item began with a definite NP or a proper name followed either by an extensional construction [*bought a saucepan* in (7a)] or an intensional one [*wanted a saucepan* in (7a')]. The target sentence (7b) always began with a definite NP lexically identical to the indefinite in the context sentence, followed by a verb in the indicative past tense. Given the similarities between the present manipulation and the one employed by Haviland & Clark, it was expected to find longer reading times for the target sentence following (7a') than (7a). However, the main interest was in the locus of the expected effect. Based on Roberts (1996) and Moltmann (1997), the prediction was to observe an effect localized at the verb position, where it becomes clear that the referent for the definite NP must be accommodated as a new discourse entity.

A set of 40 target sentences was created in the form illustrated in (7b) above. Two context-sentences for each target sentence were created, one containing an extensional construction and the other an intensional one. The intensional constructions were built using a total of 13 intensional (transitive) verbs, including, among others, *cercare* (look for), *desiderare* (wish), *temere* (fear for).The 80 sentence pairs were divided up into two lists of 40 pairs. Each list contained 20 extensional sentence pairs and 20 intensional ones, with the constraint that if an extensional pair occurred on one list, its matched intensional pair occurred on the other. Half the

[3] Cross-linguistic differences between English and Italian are assumed to be not relevant for the purposes of the experiment.

[4] The character '/' indicates the section break between the chunks of the sentences that were displayed at one time in the moving-window display.

subjects received one list, and half the other. Stimuli presentation and recording of latencies were controlled by E-Prime Software. Sentences were divided up into three chunks and presented using the moving-window technique. On the first screen, all characters of the first sentence were replaced by dashes. Participants had to press the space bar to see the first chunk of the sentence. When they pressed the space bar again, the first chunk was replaced by dashes, and the second chunk was displayed. Another press of the space bar caused the context sentence to disappear and the dashes replacing the characters of the target sentence to appear. At this point the procedure was the same as before.

Experimental items were displayed along with 139 filler sentences of various type and length. Comprehension questions, to which participants had to answer pressing one of two buttons, followed 50% of the trials. 16 native speakers of Italian took part in the experiment.

3.1.2 Results and discussion

The mean reading times for each segment of the target sentences are shown in Table 1. Data from each segment were subjected to analysis of variance (ANOVA), treating participants ($F1$) and items ($F2$) as random variables. Reading times that were 3 standard deviations above or below the mean in each phrase position were excluded by the analysis. This resulted in less than 3% of the trials discarded.

Table 1. Mean reading times [ms] for conditions by segment: 1, 2, and 3 refer to the three segments of the target sentence.

	target segments		
	1	2	3
	La pentola *(The pot)*	*costò* *(cost)*	*parecchio* *(a lot)*
Extensional context	600	572	620
Intensional contexts	594	565	609

The analysis revealed no significant differences at any phrase of the target sentence [all $Fs<1$]. Therefore, the bridging effect reported in Haviland & Clark (1974) was not replicated in the present experiment. Quite surprisingly, readers seemed to find target sentences following an intensional context as easy to process as following an extensional one. It is, however, possible, that the bridging effect was somehow masked by the way in which materials were presented. In the present experiment, whenever a new chunk appeared, the previous one disappeared. Consequently, readers were not able to reread portions of the target sentence whenever they needed to. Haviland & Clark's experiment, by contrast, used a whole sentence presentation, so that participants were able to re-access previous portions of the target sentence without restraints. The bridging effect might have emerged during such re-reading stages. In

view of this possibility, the following experiment employed the eye-tracking methodology which gives an extremely fine-grained and continuous picture of the time-course of processing, while allowing participants to read in a more naturalistic way and to look back at earlier portions of the text.

3.2 Experiment 2

3.2.1 Method and materials

The aim of Experiment 2 was twofold: first, to assess whether the failure to replicate Haviland & Clark's effect in Experiment 1 was due to the way in which materials were presented; secondly, to test Dwivedi et al. (2005) hypothesis that the interpretation of anaphoric expressions whose potential antecedents are indefinite NPs in intensional contexts requires a revision in discourse structure to compute a specific reading of the indefinite. The basic strategy to test these hypotheses was to present participants with sentence pairs in four conditions, like those illustrated in (8):

(8) a. John devoured a pastry for dessert at the dinner with his friends.
The pastry was his favourite course.

b. John wished a pastry for dessert at the dinner with his friends.
The pastry was his favourite course.

c. John devoured a pastry that his mother had prepared for him.
The pastry was his favourite course.

d. John wished a pastry that his mother had prepared for him.
The pastry was his favourite course.

As in Experiment 1, the first sentence of each item began with a proper name or a definite NP followed by either an extensional construction (*devoured a pastry*) or an intensional transitive one (*wished a pastry*). The final clause of the sentence, however, was manipulated in order to obtain a condition in which the indefinite NP in the intensional construction could be interpreted as specific. The specific reading was obtained using, for example, a 'that'-clause. In (8d), if John wished a pastry that his mother had prepared for him, it means that he wished a specific pastry. Thus, in this condition, the discourse referent associated with the indefinite can act as antecedent for the definite in the target sentence and revision strategies such as those hypothesized by Dwivedi et al. (2005) are unnecessary.

To summarize, the experimental manipulation combined two factors: the type of verb (extensional *versus* intensional) and the type of object (unspecific *versus* specific), which resulted in a 2X2 design. The verb-type manipulation allowed us to investigate whether the bridging effect found in Haviland & Clark (1974) could be replicated using the eye-tracking methodology. On this hypothesis, it was expected a

main effect of verb type with longer (re)reading times on the target sentence following an intensional context than an extensional one. The object-type manipulation allowed us to investigate the hypothesis advanced in Dwivedi et al. (2005) according to which the interpretation of the target sentence in (8b) requires a computation of a specific reading of the indefinite, which is unnecessary in (8d). On this hypothesis, it was expected an interaction between the two experimental factors, with longer reading times for the target sentence in condition (8b) compared to all the others.

The study included 32 sentence pairs in each of the four conditions. The sentence pairs were counterbalanced across conditions in four lists. Participants saw each sentence pair in one condition. A Generation 5.5 Fourward Techonologies Dual Purkinje Image eye-tracker monitored participants' eye movements. At the beginning of the experiment, participants were seated at the eye-tracker, and a bite-bar and a forehead rests were used to minimize head movements. The tracker was then aligned and calibrated using a series of nine fixation boxes that participants were asked to fixate as they appeared on the computer screen. Before each trial, a pattern of boxes appeared on the computer screen. Participants were instructed to fixate the upper left box, at which point the target text appeared, with the first characters of the text replacing the fixating box. Experimental items were presented as two written lines, with two blank lines between each line of text. The experiment included 158 filler items of various type and length. Comprehension questions, to which participants had to answer pressing one of two buttons, followed 50% of the trials. 32 native speakers of English took part in the experiment.

3.2.2 Results and discussion

For the purpose of the analysis the target sentences were devided up into two regions, the first one containing the definite NP (*The pastry*), and the second one containing the other words of the sentence. First-pass, second-pass and total reading time data for the two regions of analysis were subjected to a 2X2 ANOVA that treated both factors as within-participants ($F1$) and within-items ($F2$).

The analysis of total time data did not show any main effects or interactions. The analysis of first-pass data at the region containing the definite NP revealed an interaction between the two experimental factors that was significant only in the analysis by participants ($F1(1, 31) = 4.486$, $p<.05$; $F2 <1$). Simple effects analysis revealed that for sentences contining unspecific objects, first-pass reading times were longer when the verb was *extensional* rather than intensional, while for sentences contining specific objects there were no differences. The lack of significance in the analysis by materials, however, prevents us from generalizing this result over items (Clark, 1973). The analysis of second-pass times in the final region of the target sentence produced a main effect of object-type, which was significant by participants, and marginally significant by items ($F1(1, 31) = 5.532$, $p < .05$; $F2(1, 31) = 2.918$, $p < .1$), with longer re-reading times when the first sentence contained a specific object than an unspecific one. No other main effects or interactions were revealed in the second-pass measure.

To summarize, the experimental manipulation did not produce any main effect or interactions that could be interpreted as supporting bridging or antecedent reanalysis hypothesis. First-pass data at the definite NP, although not significant in the analysis by items, could be interpreted as an example of the 'repeated name penalty', according to which the use of a repeated NP to refer to an highly accessible referent results in more demanding integration processes (Almor 1999). The main effect of object type in second-pass reading times at the post anaphoric region appears to be unrelated to bridging or reanalysis processes as well. Thus, the question arises as to whether reference processes are affected by intensional contexts and, if so, how. The following section discusses the results with respect to a new theoretical development outlined in Frazier (2008). It will be argued that Frazier's account provides new insight into how intensional contexts affect reference processes in discourse comprehension and, more important, predicts the kind of results here reported.

4 The role of intensionality during discourse processing

The results from both Experiment 1 and Experiment 2 do not support previous accounts of reference processes in intensional contexts. The processing cost associated with sentences containing definites whose potential antecedents are indefinite NPs embedded in intensional contexts- a cost reported by both Haviland & Clark (1974) and Dwivedi et al. (2005)- has not been replicated in the present experiments. This null result, however, does not imply that intensional contexts do not affect reference processes during discourse comprehension. The previous experimental investigation on this topic, in my view, suffers from a key problem: too little attention has been paid to the processing of intensional contexts.

It has been argued, both in theoretical and empirical research, that sentences containing modal and intensional operators carry a negative presupposition (Roberts, 1996) or, in Frazier's (2008) terminology, a 'non-actuality implicature'. A sentence like *A trip should be planned for August,* for example, implies that a trip has not already been planned. Similarly, a sentence like *John is looking for a horse* implies that John has not already found one. Following Frazier's account, in this latter example, the non-actuality implicature can be represented as in (9), where Wo stands for the actual world:

(9) Wo: NOT (John finds a horse)

In this example, the implied contrast between the actual world and the asserted content may implicitly focus the content of a certain goal state that, if it was achieved, would be represented as the proposition that [*John finds a horse*]. Thus, non-actuality implicatures make salient a certain goal state that, crucially, may influence processing of subsequent elided constituents. In other words, "non actuality implicatures serve as a focusing device, guiding the processor to, *seemingly effortlessly*, build just the structure/interpretation required for elided constituents with flawed antecedents" (Frazier, 2008; p. 26, the italic is mine).

To illustrate the relevance of this prediction for our topic of research, suppose that the interpretation of a sentence pair such as (10a) requires the accommodation of an implicit restrictor for the definite NP, as illustrated in (10b):

(10) a. Mary wanted a horse for her birthday. The horse was her favourite present.
b. Mary wanted a horse for her birthday. The horse *that she got* was her favourite present.

The content of the implicit restrictor can be easily reconstructed from the non-actuality implicature carried by the context sentence (*i.e., Mary does not have an horse in the actual world*). Such implicature makes salient the goal state achieved when Mary *gets* a horse for her birthday. The content of this goal state can act as antecedent for the implicit restrictor that should be reconstruct to interpret the definite NP in the continuation sentence. The consequence for a theory of processing is that the non-actuality implicature hypothesis predicts that sentences such as those investigated in the experiments reported here are likely to be processed at no cost. In other words, the non-actuality implicature hypthesis predicts the kind of results we have found.

It remains to be explained the discrepancy between our results and those reported in the literature, particularly in Haviland & Clark (1974). One possible explanation lies in the materials used the experiments. Haviland & Clark reported only two examples of their experimental materials which, crucially, differ in the presence of a non-actuality implicature. In the first one, (a) *Ed wanted an alligator for his birthday. The alligator was his favourite present,* the context sentence implies that Ed did not have an alligator, thereby providing a salient antecedent for the definite NP. In the second one, (b) *Andrew was especially fond of beer. The beer was warm*, the context sentence does not carry a non-actuality implicature and, consequently, there is no salient goal state that can guide the reader to build an interpretation for the second sentence. As a result, the second sentence of (b) should elicit a cost, either because the reader needs to build from scratch a bridge between the two sentences, or because the bridge is even impossible to build. Since Haviland & Clark's list of materials is no longer available, we are not able to ascertain how many items were like (a) and how many like (b).

To conclude, although Frazier's account requires further investigation, what it seems to suggest is that, contrary to what has been argued in the literature, intensional contexts affect reference processes by facilitating, under certain circumstances, the recover of a coherent text representation. As a consequence, the experimental investigation of reference processes in intensional contexts cannot disregard how intensional contexts are actually processed and understood. Further investigation should take into careful consideration the semantic and pragmatic properties of intensional contexts and their influence on online sentence and discourse processing.

5 Conclusion

I have argued that the results from the studies reported here do not support previous accounts of reference processes in intensional contexts according to which comprehenders undertake costly inferential or revision processes to recover coherent text representations. The results, however, are consistent with a recent view developed by Frazier (2008), according to which non-actuality implicatures triggered by intensional contexts can guide comprehenders to effortlessly reconstruct coherent text representations. The crucial implication for future research on this topic is that the investigation of how intensionality affects discourse processing cannot disregard a detailed study of the online processing of intensional constructions.

Acknowledgements

Thanks for comments and discussion are due to: Anthony J. Sanford, Lyn Frazier, Francesco Vespignani, Massimo Poesio, Nicola Molinaro and the audience of Sinn und Bedeutung 13.

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