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Chapter 3

DETECTING AND PROCESSING INCONSISTENCIES IN NARRATIVE COMPREHENSION

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ABSTRACT

Five self-paced reading experiments investigated how different types of inconsistencies are being detected and processed in narrative comprehension. Participants read narrative texts in which a target entity (e.g., a cardigan) was introduced with two different properties: a direct property (e.g., being blue, being green) and a relational property (e.g., being too large, being too small). Later in the text, the target entity was referred to in two subsequent sentences. Depending on the particular version of the introducing paragraph, these sentences together were either consistent, inconsistent with respect to the direct property (introduced by "green and too large", referred to by "blue and too large") or inconsistent with respect to the relational property (introduced by "blue and too small", referred to by "blue and too large").

In contrast to our predictions, "direct inconsistencies" were not being detected more often than "relational inconsistencies", as was indicated by (a) reading times (Experiments 1-5) and (b) detection rates following the explicit instruction to look for inconsistencies in the texts (Experiment 2). Rather, the results suggest that relational inconsistencies are usually detected more often than direct inconsistencies. Only when participants were explicitly warned about inconsistencies in the text, were direct inconsistencies detected equally often as relational inconsistencies.

We interpret these results in the context of situation-model theory. In particular, we propose that (1) direct properties are integrated into the representations of the objects to which they apply, whereas relational properties are represented as part of individual events. (2) After a while, direct properties begin to fade until eventually they are not carried over into new representations at all. (3) Inconsistencies concerning a faded direct property often go unnoticed because they concern a type of information for which readers expect that it would be represented in the model, had relevant information been given in the text. (4) For relational properties, readers are aware of the fact that the current model

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does not contain the relevant information, and therefore initiate a backtracking mechanism that will eventually reveal the inconsistency. (5) Explicitly warning readers about inconsistencies either also prevents direct properties from fading, or results in backtracking mechanisms with both kinds of properties.

INTRODUCTION

In modern society, people are constantly confronted with new information. Provided that the information source is considered reasonably reliable, and enough mental resources are available, the individual pieces of information are being processed, possibly evaluated against background knowledge, and where appropriate, eventually integrated into the processor's knowledge or belief system. An individual's knowledge and beliefs often determine his or her perception and action. Accordingly, an individual's proper functioning is only warranted when the knowledge- or belief system is more or less consistent. Thus, the ability to detect inconsistencies between newly learned information and information present in one's knowledge- or belief system, as well as the ability to take reasonable action in the face of inconsistencies can be considered a highly important aspect of a person's cognitive apparatus. The general question of how inconsistencies are being detected, and more specifically the question concerning the conditions under which inconsistency detection may be facilitated has been a topic of some relevance in the area of syllogistic and propositional reasoning (for an overview, see Bell and Johnson-Laird, 1998; Evan, Handley, Harper, and Johnson-Laird, 1999). The question of how a person reacts to a piece of information that is determined to be inconsistent with prior knowledge or beliefs has been investigated in the area of belief revision (for an overview see Hasson, 2004). Considering that much of the information a person is confronted with is conveyed linguistically, one would expect that the detection and processing of inconsistencies was also an important research topic in the area of Psycholinguistics. However, here the detection and processing of inconsistencies was investigated mostly indirectly and as a show case for other research topics.

More specifically, in Psycholinguistics inconsistency detection has played a role mainly in three research areas. First, in studies conducted in the 1980s a contradiction paradigm was used to investigate comprehension monitoring skills of children and college students (e.g., August, Flavell, and Clift, 1984; Baker, 1979; Baker and Anderson, 1982; Garner, 1980; Glenberg, Wilkinson, and Epstein, 1982, Vosniadou, Pearson, and Rogers, 1988). In these studies, participants were presented with expository texts that contained contradictory statements, and were instructed to monitor the text for consistency. Typically, the contradictory statements employed in these studies were direct opposites of each other (e.g., *erratic changes in the opinions* / *stability in the opinions*). After reading the texts, participants were asked to rate the degree to which they felt they had understood the text they had just read. Interestingly, inconsistencies went unnoticed in a high percentage of the cases but this did not keep readers from rating their own comprehension of the text as high. The frequency of this *illusion of knowing* (Glenberg et al., 1982) was higher when the contradictory statements came at the end of a longer rather than shorter text, or when the contradictory statements were syntactically marked as *new* rather than *given.* This suggests that the failure to notice these inconsistencies has to do with the fact that not all text information is kept equally available during text processing, and not all incoming text information is

spontaneously checked for consistency with previously given information. Inconsistencies are frequently noticed only when the text is short such that the first of the contradictory statements is still highly available, or when the inconsistent information in the second of the two contradictory statements is marked as given and thereby triggers a consistency check with previously presented information (Glenberg et al., p. 601). In addition to these textual characteristics, individual differences have proved to play a role: Young children were found to be less sensitive to inconsistencies than older children or adults, and poor readers were found to be less sensitive than good readers (August, Flavell, and Clift, 1984; Baker, 1979; Baker and Anderson, 1982; Garner, 1980).

Second, a contradiction paradigm was also often used in research on discourse model construction and/or inference making. The logic underlying these studies was that if participants notice inconsistencies concerning particular aspects of the states of affairs described in a text, one can conclude that the corresponding information was represented in the discourse representation that participants had available when reading the inconsistent statement. Evidence of this type was obtained, for instance, for inferences regarding the protagonist's personality traits (Albrecht and O'Brien, 1993), inferences regarding causal relations (Noordman, Vonk, and Kempff, 1992; Singer and Gagnon, 1999), inferences regarding event duration and temporal sequencing of events (Claus, Kindsmüller, Kaup, and Kelter, 1999 and Rinck, Hähnel, and Becker, 2001 respectively), inferences regarding spatial relations (O'Brien and Albrecht, 1992, de Vega, 1995), and inferences regarding emotional aspects of the described state of affairs (Gernsbacher, Goldsmith and Robertson, 1992). In some cases, the inconsistency effects depended on the particular instructions that were given to the participants prior to reading. For instance, in the study by O'Brien and Albrecht (1992), detailed spatial information was only inferred when participants were specifically instructed to take over the protagonist's perspective. Similarly, in a study by Noordman et al. (1992) evidence for causal bridging inferences was only found when participants were explicitly instructed to monitor the text for inconsistencies (but see Singer and Gagnon, 1999).

Third, inconsistent information also played a role in research investigating selectivity and partial processing. Here, participants were typically presented with questions that presupposed information that contradicted the general world knowledge of the participants. Again, the frequency with which these anomalies are being detected is fairly low. For instance, if a participant is being asked how many animals of each sort Moses put on the ark, most will answer *2* only to be surprised later on that Moses was mentioned in the question not Noah. This *Moses illusion* (Erickson and Mattson, 1981) is conceptualized as a failure of the memory retrieval processes or the memory match processes by some authors (e.g., Reder and Kusbit, 1991), particularly when participants are presented with only one question that presupposes information inconsistent with general world knowledge. However, other authors who worked with materials consisting of longer texts ending with anomalous material (e.g., *decide where to bury the survivors*) have conceptualized the illusion as evidence for shallow processing. According to this interpretation the comprehension system will accept a term if it shows a high degree of fit with what is expected in that context, and that a full analysis of the meanings of expressions is not carried out (Barton and Sanford, 1993; Hannon and Daneman, 2004). Indeed, as one would expect on the basis of this interpretation, the frequency of the illusion depends on the semantic overlap between the actual and the correct terms, as well as on the overlap with the sentence context (Hannon and Daneman, 2001). Also, similar to what was observed in the context of the illusion of knowing, the frequency of the Moses illusion

depends on aspects of the linguistic structure of the questions or sentences. Detection rates are much higher when the linguistic focus is on the anomalous term (e.g., *It was Moses who put two of each kind of animal on the Ark*; for an overview see Sanford and Garrod, 1994). Furthermore, studies concerned with shallow processing also showed that less skilled readers are more susceptible to anomaly detection failure than readers of higher skill levels, particularly with detecting locally anomalous NPs such as *surviving dead* or *tranquilizing stimulants* (Hannon and Daneman, 2004).

In addition to the studies in these three areas of Psycholinguistics there are a few studies that directly investigated the detection and processing of textual inconsistencies, i.e., inconsistencies that arise between two propositions given in a text. A number of studies conducted by O'Brien, Albrecht and colleagues (Albrecht and Myers, 1995; Albrecht and O'Brien, 1993; Cook, Gueraud, Was, and O'Brien, 2004; Myers, O'Brien, Albrecht and Mason, 1994; O'Brien, Rizella, Albrecht and Halleran, 1998) were concerned with the details of how inconsistencies are being detected in narrative reading. As was the case for most of the studies employing an inconsistency paradigm to investigate discourse model construction and inferencing, the contradictory statements in these studies were not direct opposites (e.g., A and not A) but only became contradictory when relevant background knowledge was taken into account. Take for instance a narrative that introduces a character as being a strict vegetarian and later on describes a restaurant situation in which this character orders a cheeseburger, then this statement is inconsistent to the earlier statement only when it is taken into account that cheeseburgers contain meat and that vegetarians usually don't eat meat. On the basis of the memory-based text-processing view developed by O'Brien and colleagues (e.g., O'Brien et al., 1998), the authors assume that inconsistencies of this type are being detected as a result of a resonance process by which earlier presented text information is reactivated when it contains features in common with the (inconsistent) target sentence. Once the earlier text information is re-activated, comprehension of the inconsistent target sentence becomes disrupted because integration with the previous information is impossible. A number of findings are in accordance with this hypothesis. First, in a study by Albrecht and Myers (1995), inconsistencies with respect to a backgrounded goal disrupted the comprehension process only if a strong cue was given that presumably re-activated the earlier information. Second, in a recent study by Cook et al. (2004), the size of the inconsistency effect was found to depend on the semantic overlap between the two contradictory statements in a text. For instance, for the example above, the inconsistency was easier to detect when the non-vegetarian meal decision concerned a cheeseburger than when it concerned a tuna salad, presumably because there is a stronger negative semantic relationship between being a vegetarian and ordering a cheeseburger than between being vegetarian an ordering a tuna salad. Moreover, for the high overlap condition, the inconsistency effect was observed in the reading times for the target sentences, whereas for the low overlap condition, it was obtained for the reading times of the post-target sentences, suggesting that the resonance process took longer to activate the relevant information in the low overlap condition. Third, in a study by O'Brien et al. (1998) inconsistency effects were observed even when the earlier of the two contradictory statements was outdated or amended by inserting a qualification. For instance, for the example above, additional information in the qualified condition stated that the protagonist (a health nut and strict vegetarian) never stuck to her diet when she dined out with friends. The fact that an inconsistency effect obtained for outdated information seems to support the proposal of a passive and dump resonance process: Comprehension of the target

sentence is disrupted because the resonance process activates information with which it is inconsistent. This process does not distinguish between information that is outdated and information that is up to date. However, the results of subsequent studies have called into question this interpretation of the results. For instance, Gueraud, Harmon, and Peracchi (in press) found that the inconsistency effect in the qualified conditions disappeared when the story contained an equal number of sentences concerning the outdated and the qualified properties. Also, in study by Zwaan and Madden (2004), in which the different conditions (consistent, inconsistent, qualified) were equalized with respect to plausibility and semantic overlap, no inconsistency effect was observed in the qualified conditions.

Another study that was concerned with the reasons for why inconsistencies often go unnoticed, was conducted by Otero and Kintsch (1992). In this study, participants were presented with expository texts containing contradictory statements (direct opposites) and later on were asked to recall the text. After the recall phase, participants indicated for each of the inconsistencies whether they had noticed it or not. As in the studies on the illusion of knowing, inconsistencies went unnoticed in approximately 40% of the cases. Interestingly, participants who failed to notice an inconsistency most often recalled the corresponding text without the latter of the two contradictory statements. In other words, it seems as if participants had ignored the contradictory information. This aspect of the results is in line with the results of a study by Vosniadou, Pearson, and Rogers (1988) suggesting that children's inconsistency detection failures are related more to difficulties forming accurate mental representations of textual propositions than to difficulties in comparing the inconsistent information once it is represented in memory (p. 27). Otero and Kintsch take this finding as evidence for the idea that the failure to notice an inconsistency in a text results from exaggeration of a normal component of successful comprehension, namely differential weighting of important statements. More specifically, Otero and Kintsch assume that inconsistencies go unnoticed if the earlier of the two contradictory statements is heuristically identified as a macroproposition and assigned inappropriate strong weight, with the result being that this macroproposition dominates the network and suppresses upcoming information with which it is connected via negative associations. Thus, according to Otero and Kintsch (1992) inconsistencies should go unnoticed in conditions where the first of the two contradictory propositions is one that is likely to be chosen as a macroproposition. This prediction was not directly investigated in their experiment. However, the results of a computer simulation that was based on the construction-integration model of comprehension (Kintsch, 1988), and in which (a) different propositions were chosen as macropropositions when processing the first paragraph of the text, and (b) different reader groups were simulated by assigning different weight strengths to these selected macropropositions, successfully replicated the detection rates and recall protocols.

To summarize, studies involving contradictory information have provided evidence that inconsistencies in text often go unnoticed, and do not keep comprehenders from judging their own comprehension of the text as high. The studies have also shown that the frequency with which inconsistencies are being detected depends on the particular instruction participants are given prior to reading, as well as on properties of the linguistic form of the inconsistent statement. Instructions played a role mainly when inconsistencies were mediated by general world knowledge, i.e., when inconsistency detection reflected successful inferencing on the side of the reader. Effects of the linguistic form of the inconsistent statement depended on the type of inconsistency at hand: If the contradictory statements were direct opposites,

inconsistency detection was facilitated when the anomalous information was syntactically marked as new, presumably because givenness is a syntactic key that triggers a consistency check with previously given text information. If on the other hand the inconsistency was with respect to general world knowledge, detection of the anomaly was facilitated if the anomalous term was in the focus of the sentence, presumably because this focuses attention to the term and thereby results in a deeper processing of its meaning. Suggestions as to why inconsistencies may go unnoticed in comprehension also differ depending on the type of inconsistency at hand. The failure to detect inconsistencies between a textual statement or question and the reader's general world knowledge (as in the Moses illusion) is usually attributed to shallow processing of the terms in the anomalous statement or question. In contrast, the failure to notice inconsistencies between two textual statements is either attributed to the fact that the relevant information given by the earlier statement is not active in the reader's working memory when the second of the two contradictory statements is being processed (e.g., Cook et al., 2004; Glenberg et al., 1982) or to the fact that the relevant information given by the earlier statement is assigned too much weight and thereby suppresses subsequent information with which it is negatively connected (Otero and Kintsch, 1992).

In the present chapter we are concerned with further investigating the question of why inconsistencies often go unnoticed. In particular, we will address the idea that one of the conditions when inconsistencies go unnoticed is when *the contradictory information is appended to a segment of the cognitive representation of the text that does not directly conflict with the contradictory information* (Glenberg et al., 1982, p. 601). In other words, in this case the inconsistency goes unnoticed because the contradictory information can easily be integrated into the foregrounded part of the working memory representation of the text. Detection of the inconsistency would require to evaluate the incoming information against all of the previously given information and this in turn would mean to actively search through the non-foregrounded parts of the representation. Such an evaluation mechanism most likely is very time consuming, and it therefore seems plausible to assume that it is not routinely triggered, but only under certain conditions. These conditions for instance may be met, when participants are explicitly instructed to pay special attention to inconsistencies in the text, when the incoming information is considered highly relevant (based on the particular reading instruction or on the structure of the sentence) or when the syntax of the sentence explicitly marks the information as one that was previously mentioned.

The hypothesis that the detection rate for inconsistencies in text depends on whether the contradictory information is inconsistent with information represented in the foregrounded part of the discourse representation suggests to take a closer look at the representational assumptions of different theories of discourse comprehension, and to see whether predictions can be deduced as to which kind of inconsistencies should be particularly hard to detect. In the present paper we will distinguish between inconsistencies concerning a direct property of an object and inconsistencies concerning a relational property of an object. We will argue that situation-model theories of discourse comprehension predict a difference in the detection rates of these types of inconsistencies. But first let us define the two types of inconsistencies.

A particular property y of an object x is considered a direct property of that object if at any moment in time an isolated examination of x allows determining that y holds for x. Examples of direct properties include a cardigan that is blue or a table that has a glass top. Accordingly, an inconsistency concerning a direct property of an object is present in a text, if

the text includes two statements that assign mutually inconsistent direct properties to one and the same object (e.g., a cardigan that is blue and red at the same time). In contrast, a property y of an object x is considered a relational property of that object if determining that y holds for x requires examining x in relation to a particular other entity. Examples of relational properties include a cardigan that is too large for Mary, or a table that was recommended by the sales person. Accordingly, an inconsistency concerning a relational property of an object is present in a text, if the text includes two statements that assign mutually inconsistent relational properties to one and the same object (i.e., a cardigan that is at the same time too large and too small for a particular person). Let us now look at how direct and relation properties are represented in order to determine the predictions concerning detection rates.

In a propositional representation, direct and relational properties do not differ from each other in a significant manner. Both types of properties are simply attached to the tokens to which they apply, and should become available when the respective tokens are accessed (see Figure 1). In a situation model however, there is an important difference between the two types of properties. Direct properties can be integrated into the representation of the object to which they apply, with the result being that they become available whenever the respective object is in focus. Relational properties, in contrast, are often tied to a particular event. The narrative in Figure 2 may serve as an example.

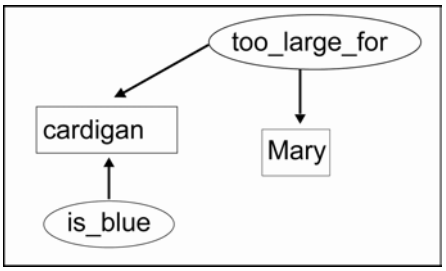

Figure 1. Propositional Representation of Direct and Relational Properties.

Figure 2. Situational Representation of Direct and Relational Properties. Note. Situation-Model Theory does not propose that situation models are pictorial in nature, detailed representations of the described states of affairs, or that they consist of a visual component only. The pictorial nature of the figure is for illustrative purposes only.

The colour blue is integrated into the representation of the cardigan, and because the cardigan stays foregrounded, so does the colour. That the cardigan is too large for Mary,

however, is only represented indirectly as part of a particular event (trying on the cardigan, for instance). Once this event is in the background, so is the respective property.

Thus, from the perspective of situation-model theory it would not be surprising if the two types of inconsistencies differed with respect to the frequency with which they are being detected in normal reading: If in a narrative, information is presented that is inconsistent with a previously introduced direct property of a foregrounded object, then this inconsistency should be easily detected, because the property is integrated into the representation of the object and should therefore be available whenever the object is in focus. If, however, the information is inconsistent with respect to a relational property of the object, then this inconsistency might well be missed, because the relational property is not integrated into the representation of the object and is therefore not necessarily available whenever the object is in focus. Thus, direct inconsistencies should be more easily detected than relational inconsistencies. In contrast, propositional theories of language comprehension would not predict differences between the two types of inconsistencies. In the following we will report five experiments, in which we investigated these predictions.

EXPERIMENT 1

Participants read narratives, each introducing a target object with several properties. Depending on the version of the introducing paragraph, two target sentences at the end of the narrative were each either consistent or inconsistent with the prior text. For the first target sentence, the inconsistency concerned a relational property of the target object, whereas it concerned a direct property for the second target sentence (see sample story in Table 1). Thus, the target paragraph of each text consisted of two sentences, that together were either consistent, inconsistent with respect to a direct property or inconsistent with respect to a relational property. Thus, if participants notice the inconsistency in the target paragraph, then paragraph reading times in versions 2 and 3 should be longer than paragraph reading times in version 1. If the two types of inconsistencies were detected at a different rate, paragraph reading times should also differ between versions 2 and 3. If the above considerations are correct, and direct inconsistencies are more frequently detected than relational inconsistencies, we would expect paragraph reading times to be longer in version 2 (inconsistent with respect to a direct property) than in version 3 (inconsistent with respect to a relational property).

Table 1 Sample Story (Experiments 1-3)

Title	**The new cardigan**
Setting	Kim was on her way home from work. She worked as a secretary in a huge law firm. It had been a hard day, and she was very tired. Several times during the day, she had apologized for things that weren't her fault. When Kim arrived at her house there was a package sitting on her doorstep. Her sister had sent her a nice cardigan. There was also a letter from her sister in the package.
Introducing Paragraph	
Version 1 (consistent)	Her sister wrote that she had bought the cardigan for herself but then realized that it not only was too large, but also the green color did not look good with her eyes.
Version 2 (inconsistent – [Dir])	Her sister wrote that she had bought the cardigan for herself but then realized that it not only was too large, but also the blue color did not look good with her eyes.
Version 3 (inconsistent – [Rel])	Her sister wrote that she had bought the cardigan for herself but then realized that it not only was too small, but also the green color did not look good with her eyes.
Filler Paragraph	Kim liked the way the cardigan looked. She went into the kitchen and prepared a sandwich for dinner. She ate the sandwich in front of the TV watching her favorite sitcom. Afterwards Kim got ready to go shopping. She put on the new cardigan, and left the house. After walking around in the mall for an hour, Kim sat down in a cafe to rest for a while. She felt the fabric of the new cardigan.
Target Paragraph	.
Relational Property	She felt very lucky that the cardigan had been too large for her sister. Kim wondered whether her sister had known that
Direct Property	green would suit her very well.
Final Sentence	Kim decided to call her sister before going to bed that night.
Question	Was Kim employed as a lawyer in a huge law firm?

Note. Each participant was presented with only one of the versions per text.

Method

Participants

Twenty-one students at Florida State University participated in the experiment for course credit.

Materials

Materials consisted of 28 narratives, 12 of which were used as experimental narratives and 16 as filler narratives. Experimental narratives were constructed according to the following schema (see Table 1). The first paragraph of each narrative described the setting of the story. In this paragraph a particular target entity (e.g., a cardigan) was introduced. The next paragraph was the variation paragraph. Here the target entity was assigned two properties, one relational property and one direct property. There were three versions of this paragraph that differed with respect to their relation to the target paragraph of the narrative. In version 1, the variation paragraph and the target paragraph were consistent, in version 2 the two paragraphs were consistent with respect to the relational property but inconsistent with respect to the direct property, and in version 3 the two paragraphs were consistent with respect to the direct property but inconsistent with respect to the relational property. The next paragraph was a filler paragraph. In this paragraph the protagonist of the story usually changed his or her location together with the target entity. The next paragraph was the target paragraph which always consisted of two sentences. Both sentences re-referred to the target entity. In doing so, the first sentence mentioned a relational property that depending on the version of the variation paragraph was either consistent with the relational property mentioned in the variation paragraph (versions 1 and 2) or not (version 3). Accordingly, the second sentence of the target sentence mentioned a direct property that depending on the version of the variation paragraph was either consistent with the direct property in the variation paragraph (versions 1 and 3) or not (version 2). Importantly, the target paragraph was the same in all versions. Thus, if reading time differences are observed for this paragraph they must be due to the different relations between the target paragraph and the variation paragraph, not to properties of the target paragraph itself. Each story was completed by a final sentence. The filler narratives were similar to the experimental narratives with respect to length, topic and structure. However, these narratives were available in consistent versions only. For each of the overall 28 narratives two simple yes/no-comprehension questions were constructed.

Design and Procedure

Each participant read all 12 experimental narratives intermixed with all 16 filler narratives. We created three lists that counterbalanced items and conditions. Each list included a different one of the three possible versions for each narrative. Each participant saw one of these lists. Thus, the design was a 3 (condition) x 3(list) design with condition being manipulated as within participants/items variable and list constituting the counterbalancing Latin square factor. Overall each participant saw 20 consistent and 8 inconsistent narratives, with 4 of the inconsistent narratives being inconsistent with respect to a direct property and 4

being inconsistent with respect to a relational property. The materials were displayed on a 17" monitor, using E-Prime version 1.1 (Psychology Software Tools, 2002). Text presentation was sentence by sentence, self-paced by the participant pressing the space-bar. Pressing the space-bar after reading the final sentence of a narrative elicited the presentation of the first comprehension question. Participants responded to the question by pressing the 'y' or 'n' key. Upon the key press, the second of the comprehension questions was presented. Participants were instructed to read carefully for comprehension but they were not told that inconsistencies were in the stories. The experimental session lasted approximately 60 minutes.

Results and Discussion

We analyzed the reading times for the target paragraph, i.e. the sum of the reading times for the first and the second target sentence.[1] The data of two participants were eliminated because they had made mistakes on one third or more of the comprehension questions pertaining to the experimental narratives. The reading times of the remaining 19 participants were submitted to 3 (condition: consistent, inconsistent_rel, inconsistent_dir) x 3 (list) analyses of variance (ANOVAs) with repeated measurement on condition in both the by-participant analysis and the by-items analysis. Paragraph reading times longer than 20000 ms or shorter than 200 ms were omitted, as well as responses falling outside of x standard deviations from the participant's mean in the respective condition, with x depending on the number of observations per condition, as suggested by Van Selst and Jolicoeur (1994). This procedure eliminated less than 4 % of the data. The mean paragraph reading times in the three different conditions are displayed in Table 2. There was a significant effect of condition, $F_1(2,32) = 20.746$, $p < .01$; $F_2(2,18) = 9.701$, $p < .01$. Simple effects revealed that both types of inconsistent paragraphs were read more slowly than consistent paragraphs (direct: $F_1(1,16) = 10.528$, $p < .01$; $F_2(1,9) = 8.988$, $p < .05$, relational: $F_1(1,16) = 32.134$, $p < .01$; $F_2(1,9) = 17.905$, $p < .01$), and that inconsistencies with respect to a relational property led to a higher increase in reading time relative to the consistent paragraph than inconsistencies with respect to a direct property, $F_1(1,16) = 13.742$, $p < .01$; $F_2(1,9) = 4.058$, $p = .075$. In fact, this particular pattern of paragraph reading times manifested itself in a highly significant linear trend with reading times increasing from consistent paragraphs to paragraphs with direct inconsistencies to paragraphs with relational inconsistencies, $F_1(1,16) = 32.134$, $p < .01$; $F_2(1,9) = 17.905$, $p < .01$.

[1] We used this dependent variable because of the advantage of having the exact same linguistic material in all conditions, which makes the interpretation of potential differences straightforward. The alternative would have been to analyze the reading times of the first target sentence in order to obtain information as to the processing of relational inconsistencies (version 1 being consistent, and version 3 being inconsistent), and the reading times of the second target sentence in order to obtain information as to the processing of direct inconsistencies (version 1 being consistent, and version 2 being inconsistent). However, with this 2(sentence) x 2(consistency) design a comparison between the two inconsistency conditions would have meant comparing effects across materials. It should be noted however, that qualitatively the reported results in all experiments do not depend on this decision: With the alternative design Experiments 1, 3, 4, and 5 produced a consistency main effect and a sentence x consistency interaction, and Experiment 2 produced only a consistency main effect.

Table 2. Mean Paragraph Reading Times / Standard Deviations (in ms) as a Function of Condition in Experiments 1-5

	Condition		
	Consistent	**Inconsistent-Dir**	**Inconsistent-Rel**
	M/SD	M/SD	M/SD
Experiment 1	Without awareness / Order Target Paragraph: Rel – Dir		
	6667 / 1479	7641 / 1737	8648 / 2202
Experiment 2	With awareness / Order Target Paragraph: Rel - Dir		
	7946/ 1646	9798 / 2110	9622 / 2290
Experiment 3	Without awareness / Order Target Paragraph: Rel - Dir		
	7210 / 1454	8178 / 1587	9235 / 1971
Experiment 4	Without awareness / Order Target Paragraph: Dir - Rel		
	7462 / 1569	8722 / 1923	9212 / 2225
Experiment 5	Without awareness / Order Target Paragraph: Rel – Dir Order in Variation Paragraph: Rel - Dir		
	6359 / 1498	7654 / 2565	8334 / 1794
Experiment 5	Without awareness / Order Target Paragraph: Rel – Dir Order in Variation Paragraph: Dir – Rel		
	7138 / 1944	7985 / 1761	8340 / 2399

The results indicate that direct and relational properties differ in some relevant way when it comes to the processing of inconsistencies. This supports the view that readers construct a situation model when comprehending a narrative. The results are not in line, however, with the more specific assumption that in a situation model, direct properties are integrated into the object representation and are therefore available whenever the respective object is in focus. Contrary to this prediction, direct properties did not lead to a stronger, but to a weaker inconsistency effect than relational properties. Before speculating on this unexpected finding we want to address two other questions that the present experiment raises: First, does the difference in the reading times for the target paragraph in the two inconsistent conditions (really) reflect a difference in the rate with which the two kinds of inconsistencies are detected? Rinck, Hähnel, and Becker (2001) have shown that reading times may be prolonged for inconsistent sentences even though the respective inconsistency was not detected by the reader.[2] Second, would the results be the same if readers had been alerted to the fact that some stories contained inconsistencies? In Experiment 2 we therefore instructed participants that there may be inconsistencies in the text. After each narrative participants were asked whether they felt that the corresponding narrative had been consistent or not.

[2] Note: The fact that the variance in Experiment 1 was higher in the relational than in the direct consistency condition does not speak against an interpretation in terms of detection rates, as long as it is assumed that even in the relational condition not all inconsistencies are being detected. For instance, if in the relational condition, 60% of the inconsistencies are being detected, and in the direct condition 30 % then we would expect to find a higher variance in the relational than in the direct condition.

EXPERIMENT 2

Method

Participants

36 students at Florida State University participated in the experiment for course credit.

Materials

Materials were the same as those employed in Experiment 1.

Design and Procedure

The design and procedure were the same as in Experiment 2, except that participants were explicitly instructed that there may be inconsistencies in the narratives. After each narrative, the participant was asked whether he or she considered the narrative as consistent. Participants responded to this question by pressing the 'yes' or 'no' key respectively.

Results and Discussion

The reading times of two participants were eliminated because they had made mistakes on one third or more of the comprehension questions pertaining to the experimental narratives.

The reading times of the target paragraph were analyzed in the same way as in Experiment 1. Less than 5.5 % of the data were eliminated as outliers. The mean paragraph reading times in the different conditions are displayed in Table 2. There was a significant effect of condition, $F_1(2,62) = 21.19$, $p < .01$; $F_2(2,18) = 11.83$, $p < .01$. Simple effects revealed that the target paragraph was read more slowly in the inconsistent compared to the consistent conditions, for both the direct and the relational inconsistencies (direct: $F_1(1,31) = 33.56$, $p < .01$; $F_2(1,9) =$, 16.11, $p < .01$, relational: $F_1(1,31) = 23.13$, $p < .01$; $F_2(1,9) = 40.10$, $p < .01$). In contrast to what was observed in the previous experiment, the two inconsistent conditions did not differ from each other, both $F < 1$.

Of the stories that were inconsistent with respect to a relational property, 70% were correctly identified as being inconsistent. The corresponding number for the direct inconsistencies was 68%. This difference was not significant (Wilcoxon Signed Ranks Test: $Z=-0.21$, $p>.80$). Thus, the rate with which inconsistencies were detected was not affected by the type of inconsistent property.

Contrary to the results of Experiment 1, property type did not affect the magnitude of the inconsistency effect in this experiment. The difference in results seems to be mainly due to the direct properties, which in this experiment produced a numerically much larger inconsistency effect (d = 1852 ms) than in Experiment 1 (d = 974 ms). Thus, explicitly informing readers about the possibility of there being inconsistencies in the stories, apparently influences the way in which the stories are being processed. It seems that readers under these conditions pay special attention to the direct properties of objects.

To conclude, the results of the present experiment do not provide evidence relevant to the question of whether the difference in paragraph reading times in the two inconsistency conditions in Experiment 1 indeed reflects a difference in the detection rates. In this experiment, the detection rates in the two conditions did not differ, however neither did the reading times. The reason seems to be that explicitly instructing participants about inconsistencies in text mainly influences the way direct properties are being processed, to the effect that direct inconsistencies do not differ from relational inconsistencies neither as far as paragraph reading times are concerned nor as far as the detection rates are concerned.

Thus, what is needed is a procedure by which assumptions regarding the detection rate can be deduced from the reading times alone. In Experiment 3 we therefore replicated the conditions of Experiment 1 but additionally recorded the reading times for the sentences prior to the target paragraph. We reasoned that the detection of an inconsistency in a particular case should manifest itself in a sharp increase in syllable reading time in the target paragraph compared to the prior filler paragraph.

EXPERIMENT 3

Method

Participants

42 students at Florida State University participated in the experiment for course credit.

Materials

Materials were the same as those employed in Experiment 1.

Design and Procedure

The design and the procedure were the same as in Experiment 1, except that in this experiment not only the reading times for the target paragraph were being measured but the reading times for all sentences in the narrative.

Results and Discussion

The reading times of the target paragraphs were submitted to 3 (condition: consistent, inconsistent_rel, inconsistent_dir) x 3 (list) analyses of variance (ANOVAs) with repeated measurement on condition in both the by-participant analysis and the by-items analysis. As in the previous experiments, paragraph reading times longer than 20000 ms or shorter than 200 ms were omitted, as well as responses falling outside of x standard deviations from the participant's mean in the respective condition, with x depending on the number of observations per condition, as suggested by Van Selst and Jolicoeur (1994). This procedure eliminated less than 4 % of the data. The mean paragraph reading times in the three different conditions are displayed in Table 2. There was a significant effect of condition, $F_1(2,78) =$

40.68, $p < .01$; $F_2(2,18) = 21.945$, $p < .01$. Simple effects revealed that both types of inconsistent paragraphs were read more slowly than consistent paragraphs (direct: $F_1(1,39) = 19.503$, $p < .01$; $F_2(1,9) = 24.013$, $p < .01$, relational: $F_1(1,39) = 66.79$, $p < .01$; $F_2(1,9) = 42.158$, $p < .01$), and that inconsistencies with respect to a relational property led to a higher increase in reading time relative to the consistent paragraph than inconsistencies with respect to a direct property, $F_1(1,39) = 26.676$, $p < .01$; $F_2(1,9) = 8.135$, $p < .05$. In fact, this particular pattern of paragraph reading times manifested itself in a highly significant linear trend with reading times increasing from consistent paragraphs to paragraphs with direct inconsistencies to paragraphs with relational inconsistencies, $F_1(1,39) = 19.503$, $p < .01$; $F_2(1,9) = 42.158$, $p < .01$. Thus, the results replicated the results of Experiment 1.

In order to obtain more information concerning the detection rates of the inconsistencies, we compared the per syllable reading times of the target paragraphs with those of the filler .paragraphs. More specifically, for both inconsistency conditions, we calculated the number of cases in which the per syllable reading time of the target paragraph exceeded the per syllable reading time of the filler paragraph by at least 50 ms. For direct inconsistencies this was the case in 52 of the overall 168 cases, whereas for relational inconsistencies this was the case in 84 out of the overall 168 cases. This differences was highly significant (Wilcoxon Signed Ranks Test: $Z = -3{,}596$, $p < .01$). Qualitatively, the same results were obtained when differences of 100 ms, of 70 ms or of 20ms were looked at (direct_100: 21/168, relational_100: 40/168, $Z = -2.8$, $p < .01$; direct_70: 43/168, relational_70: 69/168, $Z = -3.70$, $p < .01$ and direct_20: 81/168, relational_20: 113/168, $Z = -3.7$, $p < .01$, respectively). Note that with a criterion of a 70 ms difference, the mean detection rate is 30% which is similar to the mean detection rate observed in Experiment 2. These results are therefore in line with the view that the reading time differences between relational and direct inconsistencies indeed reflect a difference in the detection rates in the two inconsistency conditions.

As was mentioned above, finding a difference between relational and direct properties is in principle in line with the predictions of situation-model theory but poses a problem for propositional theories of comprehension. The reason has to do with the fact that the representational format proposed in situation-model theory is sensitive to the difference between direct and relational properties, whereas the representational format proposed in propositional theories of comprehension is not. Thus, although the particular pattern of reading times that we observed in the experiments so far does not match the predictions that we specified in the introduction, the results still seem more in line with situation-model theory than with propositional theories of comprehension. However, obviously this only holds if the difference between relational and direct inconsistencies cannot be accounted for by other confounded differences. Thus, before presenting a modified situation-model account for our main findings we will first attend to a potential confound, namely the order of the sentences in the target paragraph.

In all of the previous experiments, the relational property of the target entity was correctly or incorrectly referred to in the first of the two target paragraph sentences. The direct property was always referred to in the second of the two sentences. Thus, in the relational-inconsistency condition, the target paragraph consisted of an inconsistent sentence that was followed by a consistent sentence, whereas in the direct-inconsistency condition, the target paragraph consisted of a consistent sentence that was followed by an inconsistent sentence. In principle it therefore seems possible that the reading time difference observed in

the two conditions is not due to differences between the two property types but due to the fact that the inconsistency was contained in the first sentence in the relational condition but in the second sentence in the direct condition. For instance, processing difficulties due to detecting the inconsistency may have spilled over from the first to the second sentence in the relational condition, resulting in prolonged reading times not only of the first but also of the second sentence in this condition. This in turn would have lead to longer paragraph reading times compared to the direct condition, where the inconsistency was contained in the second sentence and therefore could not have influenced reading times of the first consistent sentence. In Experiment 4 we therefore changed the order of the two sentences in the target paragraph. In all narratives, the first sentence of the target paragraph referred to the direct property and the second sentence referred to the relational property. If the reading time differences we observed in Experiments 1 and 3 are indeed due to the order of the sentences in the target paragraph then we would expect to find a stronger inconsistency effect in the direct than in the relational conditions in this experiment. If however, the difference is due to the differences between the two types of properties, then we would expect to again find a stronger inconsistency effect for the relational than for the direct properties.

EXPERIMENT 4

Method

Participants

39 students at Florida State University participated in the experiment for course credit.

Materials

Materials were the same as those employed in Experiment 1, except that in all narratives the order of the sentences in the target paragraph was reversed. Thus, in the example in Table 1, the target paragraph for this experiment would read: *She wondered whether her sister had known that green would suit her very well. Kim felt very lucky that the cardigan had been too large for her sister.*

Design and Procedure

The design and the procedure were the same as in Experiments 1 and 3.

Results and Discussion

As in Experiments 1 and 2, the reading times of two participants were eliminated because they had made mistakes on one third or more of the comprehension questions pertaining to the experimental narratives. The reading times of the target paragraphs of the remaining 37 participants were analyzed in the same way as in the previous experiments. Less than 4 % of the data were eliminated as outliers. The mean paragraph reading times in the three different

conditions are displayed in Table 2. There was a significant effect of condition, $F_1(2,68) = 25.685$, $p < .01$; $F_2(2,18) = 28.687$, $p < .01$. Simple effects revealed that both types of inconsistent paragraphs were read more slowly than consistent paragraphs (direct: $F_1(1,34) = 22.734$, $p < .01$; $F_2(1,9) = 60.905$, $p < .01$, relational: $F_1(1,34) = 57.004$, $p < .01$; $F_2(1,9) = 39.331$, $p < .01$), and that inconsistencies with respect to a relational property led to a higher increase in reading time relative to the consistent paragraph than inconsistencies with respect to a direct property, $F_1(1,34) = 4.217$, $p < .05$; $F_2(1,9) = 5.587$, $p < .05$. In fact, this particular pattern of paragraph reading times manifested itself in a highly significant linear trend with reading times increasing from consistent paragraphs to paragraphs with direct inconsistencies to paragraphs with relational inconsistencies, $F_1(1,34) = 57.004$, $p < .01$; $F_2(1,9) = 39.331$, $p < .01$. Thus, the results in this experiment replicate the results of Experiments 1 and 3, and thereby speak against an explanation in terms of the order of the sentences in the target paragraph. In this experiment, the direct property of the target entity was referred to in the first of the two target sentences, and correspondingly a stronger inconsistency effect should have emerged for the direct properties not a weaker one.

There is still one other difference between the two inconsistency conditions that could in principle be responsible for the differences in reading times observed in these conditions, namely the order of mentioning in the variation paragraph. In the reported experiments the relational property was mentioned first in 8 of the 12 experimental narratives. Thus, in principle a significant difference between the two conditions could have obtained just on the basis of the eight narratives for which the relational property was mentioned first. Such a result would not be implausible, considering that information that is mentioned first in a sentence has been shown to be particularly available after reading (advantage of first mention, Gernsbacher, 1997). Thus, on this interpretation of the results, the reason why relational properties were associated with higher detection rates than direct properties in the previous experiments would reflect the fact that these properties were marked as more relevant and were accordingly represented more carefully when processing the variation paragraph. Obviously, if this interpretation is correct, then the difference between the two conditions could not be taken as positive evidence for situation-model theory. In order to obtain more information regarding the effect of the order of mentioning in the variation paragraph, we included this variable as a manipulation in the design of Experiment 5.

EXPERIMENT 5

Method

Participants

48 students at Florida State University participated in the experiment for course credit.

Materials

Materials were the same as those employed in Experiment 1, except that we wrote an additional three versions for each of the experimental narratives. These versions were the same as the first three versions, except that the order of mentioning the relevant properties in the variation paragraphs was reversed. In other words, in three of the overall six versions of each narrative, the relational property was mentioned first, and in the remaining three versions, the direct property was mentioned first (e.g., *Her sister wrote that she had bought the cardigan for herself but then realized that the green color of the cardigan did not look good with her eyes, and that the cardigan was too large.*).

Design and Procedure. The design was a 3 (consistency condition) x 2(order: direct-relational vs. relational-direct) x 6(list) design with consistency condition and order being manipulated as within participants/items variables and list constituting the counterbalancing Latin square factor. Each participant saw 12 experimental narratives, four of which were consistent, four inconsistent with respect to a relational property and four inconsistent with respect to a direct property. Of each of these four narratives, 2 were presented in the direct-relational order and two in the relational-direct order. In addition, each participant saw 16 consistent filler narratives. Thus, overall each participant saw 20 consistent and 8 inconsistent narratives. The procedure was the same as in Experiment 1.

Results and Discussion

The data of one participant were eliminated because (s)he had made mistakes on one third or more of the comprehension questions pertaining to the experimental narratives. The remaining reading times were analyzed in the same way as in the previous experiments. Approximately 2 % of the data were eliminated as outliers. The mean target paragraph reading times in the six different conditions are displayed in Lines 5 and 6 of Table 2. As in the previous experiments, there was a highly significant main effect of consistency condition, $F_1(2,80) = 28.388$, $p < .01$; $F_2(2,18) = 11.749$, $p < .01$. [3] There was also an effect of the order in which the direct and relation properties were mentioned in the variation paragraph, but this effect was only significant in the by-participants analysis, $F_1(1,80) = 4.98$, $p < .05$; $F_2(2,18) = 2.583$, $p = .14$. Most important to the issue at hand, the two factors did not interact, both Fs <1.

To obtain more information regarding the differences between the three consistency conditions, and the role that the order of mentioning plays for these differences, separate 2 (consistency condition) x 2(order) ANOVAs were being calculated for the three possible comparisons. These analyses revealed that the target paragraph was read more quickly in the consistent conditions than in both of the inconsistent conditions, but these effects were only significant in the by-participants analyses (direct: $F_1(1,43) = 23.21$, $p < .01$; $F_2(2,18) = 2.583$, $p = .14$; relational: $F_1(1,40) = 64.23$, $p < .01$; $F_2(2,18) = 2.583$, $p = .14$). The order in which the information was being introduced in the variation sentences, if at all had a main effect on the reading times (direct: $F_1(1,43) = 8.81$, $p < .01$; $F_2(1,9) = 1.77$, $p > .20$; relational: $F_1(1,40)$

[3] Note: The reduced degrees of freedom in the by participant analyses are due to the fact that after outlier elimination, four participants did not have values in all of the six conditions. Accordingly, the analyses presented here are based on 43 participants

= 3.17, p = .08; $F_2(1,9) = 3.063$, p = .11), but did not interact with the consistency effect (direct: $F_1 < 1$; $F_2(1,9) = 1.064$, $p > .30$; relational: $F_1(1,40) = 1.63$, $p > .20$; $F_2(2,18) = 1.91$, p = .20). The analyses comparing the two inconsistent conditions with each other neither produced a main effect of order nor an order-by-consistency interaction, all Fs < 1. Rather, the analyses revealed that the target paragraph was read more slowly in the relational than in the direct condition, whereby this effect again was only significant in the by-participants analysis, $F_1(1,40) = 9.68$, $p < .01$; $F_2(1,9) = 1.92$ p = .20.

The results of this experiment replicate our earlier results: Relational inconsistencies were read more slowly than direct inconsistencies. The contribution of the present experiment was to show that this effect is independent of the order in which the two properties were being mentioned in the variation paragraph. Order of mentioning if at all only had a main effect on the reading times of the target paragraphs. This main effect was not predicted but may reflect the fact that participants prefer to read the sentences in the target paragraph in the same order as the corresponding properties were introduced in the variation paragraphs.

To conclude, the results of the present experiment are in line with the view that relational properties indeed differ in a relevant way from direct properties when it comes to the detection and processing of inconsistencies in narrative comprehension. As was argued in the introduction, finding a difference between the two types of properties is in line with situation-model theory but poses problems for propositional theories of comprehension. However, the particular reading time pattern that we observed in the experiments reported above does not match the predictions that we derived from situation-model theory in the introduction. In the following section we will present an account of the present findings that is based on situation-model theory and differs from the assumptions made in the introduction in minor aspects only.

GENERAL DISCUSSION

In five experiments, participants read longer narratives in which a particular target entity (e.g., cardigan) was introduced with two different properties: a direct property (e.g., being blue, being green) and a relational property (e.g., being too large, being too small). Later in the text, the target entity was referred to in two subsequent sentences in the target paragraph. Depending on the particular version of the introducing paragraph, these target sentences were either consistent, inconsistent with respect to the direct property (introduced by "green and too large", referred to by "blue and too large") or inconsistent with respect to the relational property (introduced by "blue and too small", referred to by "blue and too large"). Analyzing the reading times of the target paragraph revealed a number of relevant results.

First, reading times of the target paragraph were significantly longer in the inconsistent versions than in the consistent versions. This was the case, independent of whether participants were instructed about the possibility of there being inconsistencies in the narratives (Experiments 1, 3, 4, 5) or not (Experiment 2). Second, inconsistencies of the type investigated in the reported experiments, went unnoticed by the readers in about 30% of the cases (Experiment 2). Third, if participants were not warned about inconsistencies in the narratives, reading times for the target paragraphs were longer when they were inconsistent with respect to a relational property than when they were inconsistent with respect to a direct

property (Experiments 1, 3, 4, 5). In contrast, when participants *were* warned, both types of inconsistencies lead to an equal increase in reading time relative to the consistent condition (Experiment 2). The difference in the two reading-time patterns seems mostly due to the direct inconsistencies, where the informed participants of Experiment 2 produced a much larger effect (d = 1852 ms) than the non-informed participants of the other experiments (d =1069 ms). Fourth, a comparison of the per-syllable reading times of the target paragraph with the per-syllable reading times of the prior filler paragraph (Experiment 3) indicated that relational conditions differed from direct conditions with respect to the frequency with which the reading times increased sharply relative to the filler paragraph. Provided that such a sudden increase in the per syllable reading time may reflect that the corresponding participant has detected an inconsistency in the corresponding narrative, this results is in line with the view that the difference in reading times between the direct and the relational conditions reflect differences in the detection rates of the corresponding inconsistencies. In accordance with this view, the pattern of explicitly surveyed detection rates corresponded to the pattern of target paragraph reading times in Experiment 2. Finally, the difference between the direct and the relational inconsistencies proved to be independent of the order in which the properties were being referred to in the target paragraph (Experiment 4) as well as of the order in which they were being mentioned in the variation paragraph at the beginning of the narrative (Experiment 5). To sum up, the results suggest that inconsistencies in narrative texts go unnoticed by the reader more often when they concern a direct property than when they concern a relational property.

In the introduction we followed Glenberg et al. (1982) in hypothesizing that inconsistencies often go unnoticed because the inconsistent information gets inserted into a part of the discourse representation that does not contain the original information with which the incoming information stands in conflict. Thus, according to this interpretation, inconsistencies go unnoticed because the foregrounded part of the discourse representation does not contain the relevant information, and comprehenders accordingly do not spontaneously trigger a checking mechanism by which the whole discourse representation is searched through. We also hypothesized that direct and relational properties differ with respect to whether or not they are represented in the foregrounded part of the discourse representation, provided that the corresponding entity is represented therein. It was argued that direct properties in contrast to relational properties could be integrated into the representation of the entity to which they belong, and that this in turn would imply that direct but not relational properties are present in the representation as long as the corresponding entity is present. Accordingly we predicted that inconsistencies with respect to a direct property would be detected more easily than inconsistencies with respect to a relational property because for direct but not for relational inconsistencies the inconsistency would be apparent by inspecting the foregrounded part of the discourse representation. This prediction was not borne out by the data. The detection rates for direct inconsistencies were not higher but rather lower than those for relational inconsistencies. Thus, the results were exactly the opposite of what we had predicted. How can the above assumptions that were deduced from situation-model theory be accommodated with this finding? We will argue that only minor adjustments are necessary to account for the results.

In our view, the results of the present experiments can be accounted for on the basis of the hypotheses outlined in the introduction when assumptions are added regarding the dynamics of the representation over time as well as regarding meta-cognitive strategies. More

specifically, five assumptions are needed: First, direct properties are integrated into the representations of the objects to which they apply whereas relational properties are represented as part of individual events. Second, after a while, direct properties begin to fade until eventually they are not carried over into new representations at all. Third, inconsistencies concerning a faded direct property may often go unnoticed because they concern a type of property for which readers expect that it would be represented in the foregrounded part of the discourse representation, had relevant information been given in the text. Fourth, for inconsistencies concerning a relational property, in contrast, readers are aware of the fact that the foregrounded part of the discourse representation cannot contain the relevant information. They therefore often (but not always) initiate a backtracking mechanism that will eventually reveal the inconsistency. Fifth, explicitly warning readers about inconsistencies either prevents direct properties from fading, or results in backtracking mechanisms with both kinds of properties.

Two potential problems with this interpretation come to mind. First, the interpretation presupposes that the reading time difference between the two inconsistent conditions reflect a difference in the detection rates for the two types of properties. The present experiments did not produce evidence to the contrary and the particular per-syllable reading-time analyses carried out in Experiment 3 are in line with this view. However, strictly speaking, we cannot be sure that this is really the case. Second, if backtracking mechanisms in the non-informed condition are more often initiated with relational than with direct properties, shouldn't the reading times in this condition be longer for the relational than for the direct properties? That this is not generally the case may reflect that readers update their model according to the new text information in conditions where they do not backtrack, which is likely to be time consuming as well.

CONCLUSION

The results of the present experiments speak against theories that assume that text comprehension results in a propositional representation of the text. Rather, the results suggest that comprehension is tantamount to mentally representing the state of affairs that the text is about. The results thereby provide evidence against propositional theories of language comprehension and for situation-model theory. In addition to these more global theoretical implications, the results also have implications with respect to the question of how inconsistencies are being detected and processed in narrative comprehension. More specifically, the results replicate earlier results by providing evidence that a considerate number of inconsistencies go unnoticed in reading. The results moreover provide evidence for the intuitive claim that one major factor in predicting whether or not a particular inconsistency will go unnoticed in reading is whether or not the information is likely to be represented in the part of the discourse representation that the reader has available when encountering the inconsistent information. One contribution of the present chapter was to show that situation-model theory offers a promising framework for predicting what information is available in the foregrounded part of the discourse representation at a given point in time, and accordingly, can be taken as a starting point for predicting the detection rates for different types of inconsistencies in narrative comprehension. Another contribution

was to illustrate that the detection and processing of inconsistencies in narrative comprehension constitutes an interesting test case for situation-model theory. Empirical evidence related to this topic not only allows evaluating the theory but also allows drawing new conclusions with respect to the processes that operate on situation models in narrative comprehension.

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