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The impact of connectives and anaphoric expressions on expository discourse comprehension

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Abstract

This study focuses on the impact of linguistic markers of coherence on the comprehension of expository discourse. The impact of such markers on comprehension (i.e. off-line) is a highly controversial topic in current studies, especially for connectives for which a facilitating as well as an interfering role has been demonstrated. As a matter of fact, it seems that connectives facilitate the comprehension process in that they improve the reading process, but that they do not increase comprehension of the text. It might even be possible that they ease the reading task in such a way that they provide the reader with the “impression” of having understood the text instead of a real understanding.

The objective of the experiment was to test this far reaching hypothesis for the use of connectives in expository texts. We wanted to determine the impact of causal connectives such as *because* (‘parce que’) and *so* (‘donec’) on comprehension and on the feeling of understanding, contrasting it with the impact of anaphoric expressions. Contrary to previous results, our experiment shows that the

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presence of connectives actually improved comprehension while it did not have an impact on the feeling of understanding.

Keywords: discourse comprehension, processing, referential and relational coherence, meta-cognition

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Introduction

Nowadays reading and understanding texts has become an essential task in our society. In this context, research that focuses on the improvement of text comprehension is important. In the last two decades, psycholinguistic models of comprehension have been developed permitting a clearer insight into the difficulties encountered by a number of readers or produced by certain texts.

Understanding a text consists in incrementally constructing a coherent representation of its content (Graesser, Millis & Zwaan, 1997). To this end readers have to determine the relations that exist between successive sentences (local coherence) as well as between the different parts of the text (global coherence). To establish this coherence the reader partially draws on the cohesive devices (in Halliday and Hasan's (1976) terminology) present in the text; that is the linguistic markers of coherence that explicitly signal the relations existing between different discourse segments. Consequently, it is likely that one could improve the comprehension of a text by increasing its cohesion. As a matter of fact, this has been demonstrated in a number of studies (Britton, 1994; Britton & Gülgoz, 1991; Marshall & Glock, 1978; Murray 1995).

A first problem with these studies is that they do not account for the important problem that helping readers to establish the coherence of a text by using cohesive devices, may give the readers the false impression to have understood its content (see; e.g., Glenberg, Wilkinson, & Epstein, 1982). So, studies in text comprehension should also address the problem that helping a reader read a text smoothly, may at the same time lead to the false illusion of understanding the text (see below).

A second problem with the cited studies on text comprehension is that the complexity of the phenomenon of coherence markers has not been fully taken into account. Very often they have been treated in a very general and global way without making any distinction between the different categories that compose them. For instance, Britton and colleagues' work only handles matters

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linked to *referential* coherence neglecting effects of *relational* coherence. The former can be defined as considering continuity of referents in the text: a link is made between two propositions by retrieval of an argument. In contrast, we refer to relational coherence to account for the conceptual relationships that hold between text segments, the so-called coherence relations like *cause-consequence*, *problem-solution* or list. Referential and relational coherence may be linguistically marked by different cohesive devices: anaphoric expressions are typically used to account for referential continuity and connectives and adverbials to signal relational coherence relations (see examples (1-2), respectively).

(1) a. Si auparavant la qualité principale du gymnaste était la force, l'accent fut de plus en plus mis sur la vitesse grâce à la technique de l'élan. L'évolution de la gymnastique rythmique est une bonne illustration de cette métamorphose. **Il** a permis la réalisation d'exercices plus audacieux et plus artistiques.

b. Si auparavant la qualité principale du gymnaste était la force, l'accent fut de plus en plus mis sur la vitesse grâce à la technique de l'élan. L'évolution de la gymnastique rythmique est une bonne illustration de cette métamorphose. **L'élan** a permis la réalisation d'exercices plus audacieux et plus artistiques.

'While the main quality of the gymnast had been his strength, speed became more stressed with the technique which focussed on gathering momentum. The evolution of eurythmics is a good illustration of this metamorphosis. **It (masc.)/The momentum** made the realization of more daring and more artistic exercises possible.'

(2) a. Pour désigner les ouragans, les météorologues utilisent des prénoms **parce qu'**une série de chiffres comme la latitude et la longitude sont difficiles à retenir.

b. Pour désigner les ouragans, les météorologues utilisent des prénoms. Une série de chiffres comme la latitude et la longitude sont difficiles à retenir.

'To designate hurricanes, meteorologists use first names **because/ø**. a/A series of figures like

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latitude and longitude are difficult to memorize.’

What do we know so far about the role of relational and referential coherence markers in text comprehension?

RELATIONAL COHERENCE

The impact of markers of relational coherence, such as connectives, on the reading process has been the topic of investigation in many different types of research. Since we are interested here in their influence on the comprehension of expository *texts*, we will leave aside the numerous studies that try to establish the role of connectives in two-sentence pairs (see, e.g., Caron, Micko & Thuring, 1988, Golding, Millis, Hauselt, Sego, 1995; Millis & Just, 1994; Traxler, Bybee & Pickering, 1997) and concentrate on discursive and textual approaches to the problem. Although the precise role connectives play in text comprehension is still a controversial topic (see below), one may assume that they influence both the reading process and the reading result of a text, i.e. the mental representation constructed by the reader. There is indeed much empirical support for the position that connectives and other linguistic coherence markers play a facilitating role *during* the reading process, i.e. on-line (Bestgen & Vonk, 1995; Haberlandt, 1982; Sanders, 1992, Sanders & Noordman, to appear). With respect to the influence of explicit coherence markers on the text representation afterwards, i.e. off-line, the positions are not so straightforward. On the one hand, there are a few studies according to which linguistic marking *does* improve the mental text representation (better recall, better comprehension). Meyer, Brandt and Bluth (1980) investigate the relationship between the reading strategy and signaling of discourse structure trying to find out whether signaling leads to a “structure reading strategy”. They find an effect of signaling on the immediate free recall but this effect has disappeared in the delayed free recall. This difference is probably due to the scoring method used for the recall, since idea units were scored only when they

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corresponded explicitly to the wordings used by the author. The effect here is probably one of surface structure rather than of an improved mental representation. In addition all kinds of signaling devices were used so that the specific effect of connectives is not apparent. Loman and Mayer (1983) also show that the reading strategy and subsequent pattern of recall is different for “signaled” and “non-signaled” texts, where signaling involves previews, headings and logical connectives. In particular, signaling seems to encourage the reader to build a coherent learning outcome that is transferable to new situations. However, in this study different signaling techniques are used which may not be equally useful. It follows from this that the specific role of connectives in this context is still not clear-cut. On the other hand, there are a number of studies that clearly contrast with these findings. In particular, the study of Millis, Graesser and Haberlandt (1993) comes to the conclusion that linguistic marking of coherence relations has a negative impact on the mental text representation. According to their results, connectives do not improve memory for expository texts describing scientific mechanisms. Instead, texts without connectives resulted in slightly greater recall than texts containing connectives. Along the same line, other studies have also shown that connectives do not necessarily facilitate the comprehension of expository texts (Meyer, 1975; Sanders, 1992; Sanders & Noordman, to appear; Spyridakis & Standal, 1987).

So, if we further consider this negative impact of connectives on text comprehension and recall, one would have to explain how connectives can both improve the on-line processing of a text and simultaneously lead to a poor mental representation.

According to Millis et al. (1993), connective interference can occur “because the connective [constrains] readers from generating additional elaborations beyond the explicit connective” (Millis et al., 1993 : 335). When *no* connective is present, readers cannot rely on linguistic cues so they have to generate inter-statement elaborations for themselves. This additional processing may anchor the information in a more solid way and help them to recall the information at retrieval. Similarly, Noordman, Vonk and Kempff (1992) found that connectives tend to speed up reading

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time (i.e. on-line), but lower inferencing. Actually, the presence of a connective speeds up the *integration* process, i.e. the reader accepts the conceptual relation without checking it to his/her knowledge base (Noordman & Vonk, 1997). Because the connectives spell out the intended coherence relation, readers may tend to rely on the linguistic cues only without making the underlying relational inferences. These findings conform to the view that the use of discourse markers such as connectives could increase the *passivity* of readers (Fayol, Gombert, Lecocq, Sprenger-Charolles, & Zagar, 1992), i.e. readers satisfy themselves with shallow processing because no deeper active processing is required. This shallow processing could lead to the false illusion to have understood the content of the text (cf. supra). The passivity hypothesis is also in accordance with the studies of McNamara, E.Kintsch, Songer, and W.Kintsch (1996) on the impact of coherence markers according to the reader's expertise, high-knowledge readers benefiting more from a minimally coherent text, and low-knowledge readers more from fully signaled texts. It is, however, important to note that these latter studies consider relational as well as referential coherence, but *without* taking into account the specific effects of each of the two types.

At this stage, one could then arrive at the far reaching conclusion for the design and improvement of texts that increasing the relational coherence of a text is not necessarily beneficial for its comprehension.

However, before we accept such a conclusion other explanations regarding the absence of impact of connectives on text comprehension should be taken into consideration, too. In particular, the design of the experimental texts should be given special attention since the naturalness of the experimental texts and the adequacy of the used connectives could also influence the final outcome in a decisive way. Millis et al. (1993) state themselves that it is possible that their conclusions on the negative impact of connectives in expository texts do not hold for longer and more complicated texts than the ones used in their experiments. It seems obvious that in order to test the structuring role of discourse markers, longer texts are needed, but most of all attention should be paid to the

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plausibility of the discourse marker in the given context. That is, connectives should not be considered as linguistic elements that can be “plugged in” between any two sentences regardless of their content. Proceeding as such results in very unnatural texts (cf. Caron et al., 1988; Millis et al., 1993). In any case, there must be a plausible match between the meaning of the connective and the content of the related segments in order to avoid a discrepancy between the underlying coherence relation and the used connective. This means that one cannot study the impact of connectives by simply varying the type of connectives in a same basic text. For every tested connective an adequate and plausible context should be given. It follows from this that the absence/presence of connectives should not change the overall *content* of the text.

REFERENTIAL COHERENCE

Turning now to the role of referential markers of coherence, it seems that their impact on text comprehension has been established in a more solid way. As a matter of fact, several studies support the position that absence of referential cohesion between two successive sentences harms comprehension (Clark & Haviland, 1977; Lesgold, Roth & Curtis, 1979). Work by Kintsch and colleagues (Kintsch & Vipond, 1979; Miller & Kintsch, 1980) on readability establishes a relationship between comprehension problems caused by a text and the presence of breaks in its referential continuity. Along the same line, Britton and Gülgoz (1991) have demonstrated that it is possible to improve the comprehension of a text by indicating explicitly those concepts that enable two successive sentences to be linked together, thus increasing the referential cohesion of the text. However, these studies did not distinctively take into account the different linguistic means that may be used to establish this referential coherence, e.g. nominal and pronominal anaphora. So, while it seems without a doubt that absence of referential cohesion disturbs comprehension, the question is still open as to how referential coherence is marked and how this affects comprehension.

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Actually, it has been established that there are strong discourse constraints on the use of specific anaphoric expressions (Ariel, 1990; Givón, 1983, 1992; Sanford & Garrod, 1994; Vonk, Hustinx & Simons, 1992). In particular, the type of anaphora used depends on the degree of accessibility of the antecedent with a scale that ranges from zero-anaphora until definite noun via pronoun and referential indefinite noun. A pronoun is usually used to refer to a focused or centered antecedent while a repeated-name anaphora is more adequate when the referent is less available (Garrod & Sanford, 1994; Gordon & Hendrick, 1997).

As with the connectives, a number of studies have shown that on-line processing *is* affected by the type of referential expression used. Adequate use leads indeed to faster reading times (Gordon, Grosz, & Gilliom, 1993; Kennisson & Gordon, 1997). However, little research has tackled the impact of these expressions on the mental representation built and its availability in time.

A parallel study of this factor and of relational coherence should not only enable us to explore two methods of improving text comprehension. It should also help evaluate the respective weight of these two types of cohesion.

EXPERIMENT

The aim of the experiment was to test the impact of linguistic markers of relational and referential coherence on the comprehension of expository discourse.

Participants read expository texts and answered comprehension questions. In some texts, we manipulated the presence or absence of causal connectives, in others we manipulated the easiness with which readers could resolve anaphora. Doing this, we took care not to disturb the quality of the texts (adequately used and relevant connectives, texts that were long enough, etc.) so as to arrive at two versions of the texts that would be as natural as possible.

As for our hypotheses, we predict a better comprehension of the “easy” anaphoric versions

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which should hence give rise to better question answering. With respect to the impact of connectives we are in presence of two competing hypotheses. Either we obtain a positive impact of the presence of connectives on text comprehension thanks to the use of longer texts and adequately used connectives, or we replicate previous results and do not observe any beneficial effect of the connectives. In this latter case we would have to test the passivity hypothesis according to which readers satisfy themselves with shallow processing, because no deeper active processing seems to be required. To this end, we asked the participants to evaluate their feeling of understanding for every text. According to the passivity hypothesis, readers should overestimate their performances on the comprehension task when connectives are present.

Method

Participants

Fifty-three participants, all second year Psychology students (+/- 20 years old) at the University of Louvain (Louvain-la-Neuve) and native speakers of French, took part in the experiment for course credit.

Materials

The experimental material consisted of ten expository texts of approximately 200 words [min. 190 / max. 213]. All texts were based on original encyclopedic or popular scientific articles and covered topics like *Gymnastics* ('La gymnastique'), *Tornados and hurricanes* ('Tornades et ouragans'), *Bone marrow transplant* ('La transplantation de moelle osseuse'). Six texts were meant to study the impact of connectives and four to study referential cohesion. Initially, we planned to use six texts for each part of the study, but a pre-test experiment showed that the task would be too long. We discarded two texts in the referential condition because we expected a stronger effect in that condition than in the connective condition.

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We wrote two versions of each of the texts, a “more cohesive” one and a “less cohesive” one. For the connectives, the more cohesive version contained at least three causal connectives of which two signaled a backward causal relation (*car* ‘because/for’, *parce que* ‘because’, *puisque* ‘since’) and one a forward causal relation (*donc* ‘so’, *dès lors* ‘it follows that’). To produce the less cohesive version, these three causal connectives were left out and replaced by a full stop in case of inter-sentential use. The texts also contained other (causal or non-causal) connectives that were not manipulated. Text (3) is an example of a “more cohesive-connective” text, translated from French. The original French version is included in the Appendix. For illustrative purposes, the manipulated connectives are here underlined.

(3) No other biting insects inspire such apprehension in the forested parts of central Canada as do black flies or simuliidae. In summer and autumn these flies can be so numerous that outdoor activity during the day becomes almost impossible. Most of them do not bite, because a degeneration of their mouth parts enables them to feed on flower nectar only. However, their buzzing presence and constant crawling are particularly irritating. Among the many species of black flies, only two species complexes are severe pests. In the early summer, it is especially the Simulium “Venestum” that is most aggressive. During that period of the year, the Simulium “Decorum” escape detection because they are outnumbered by the other species. In autumn, they become particularly aggressive. The only solution to this plague is to protect oneself. It is much better to wear a light-coloured shirt because black flies find dark hues more attractive. Nonetheless, it is very important to attract the flies away from the head region. So, dark blue jeans might be better than pale trousers provided they are without holes.

To produce the more and the less cohesive versions of the texts that were meant to study referential

coherence, we manipulated three nominal entities that referred to an antecedent mentioned two or three sentences earlier. This antecedent was never in the scope of special attention (non-topicalized, non-focalized) and it did not refer to the general theme of the text. In the more cohesive version, the anaphoric link was unambiguous because the referential expression used was a definite iteration of the antecedent. In the less cohesive version, we used an anaphor that was difficult to resolve, e.g. because it was too far from its antecedent, or ambiguous in the context because it could also refer to entities other than the antecedent. Text (4) is an example of a “less cohesive-anaphoric” text, translated from French. The original French version is included in the Appendix. For illustrative purposes, the manipulated anaphora are here underlined. In the “more cohesive-anaphoric” text, the underlined anaphora were replaced by full lexical nouns (the *success*, *the momentum*, and *the counting system*, respectively).

- (4) Gymnastics was founded by a Swede at the end of the 18th century. At that time, it was a particularly demanding exercise requiring movements based on the physical laws of the organism. Success was immediate because its goal was the harmonic development of the body. It did, however, not last, as it became the victim of numerous critiques concerning the too great statism of this discipline. Other methods were proposed at the end of the 19th century, but it was only in 1936 that gymnastics became a sport on its own. While the main quality of the gymnast had been his strength, speed became more stressed with the technique which focussed on gathering momentum. The evolution of eurythmics is a good illustration of this metamorphosis. It made the realization of more daring and more artistic exercises possible. Furthermore, the acknowledgment of gymnastics as an Olympic discipline implied the elaboration of a universal counting system. In every competition, there is now a free exercise as well as an imposed one. It is used in order to judge the originality and the rigor of the gymnast’s movements.

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Four short-answer questions were prepared for each text. Two of them tapped the cohesive manipulation; that is the causal relation marked by absence or presence of a connective or the antecedent of the “easy” or “difficult” referential expressions (see questions (5) and (6) relating to text (3)). The two other questions covered other non-manipulated parts of the text (see questions (7) and (8), again relating to text (3)).

(5) In fly-infested regions, why is it better to wear dark jeans in summer?

(6) How can one explain that the *Simulium* “decorum” escapes detection in summer?

(7) In what part of Canada the flies are most disturbing?

(8) Why are most of the black flies not dangerous?

To estimate the feeling of understanding, participants answered two meta-comprehension questions. The first prompted them to estimate their feeling of understanding of the text on a 0-20 scale (a usual scale for Belgian university students). Secondly, they were asked to predict the number of questions they thought they would answer correctly. Participants answered these questions twice: once before seeing the comprehension questions and once after having answered them.

Finally, twelve arithmetical word problems were written to serve as distractors between the reading of a text and the answering of the questions.

Design

Two counter-balanced sets of materials were constructed. Each set contained the ten texts: three of the connective texts were in the more cohesive and three in the less cohesive version; two of the referential texts were in the more cohesive, and two in the less cohesive version. Across the two sets, each connective text appeared once in each experimental condition and the same was true

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for the referential texts. A random order of the texts was constructed. Half of the participants saw the texts following this random order, and half saw them in reversed order. This left us with four booklets of texts: two for each set of materials, one in each order.

Procedure

Texts were assembled in booklets. For each text, there were seven pages. The first page identified the text by a letter. The text was printed on the second page. On the third page, there was a short arithmetical word problem used as a distracting task. The fourth page showed the meta-cognitive questions. Pages five and six contained the comprehension questions, two on each page. On the seventh and last page participants answered again two meta-comprehension questions: the first one to rate their feeling of understanding and the second to estimate the number of questions they thought they had actually answered correctly.

Participants were tested by groups of ten to fifteen in a classroom. To keep subjects synchronized over the different tasks, time to process each task had been fixed according to a pilot study. Ninety sec. were allowed for reading each text, 30 sec. for answering the arithmetical word problems and 120 sec. for answering all the questions. At each transition point, the experimenter gave the signal to start. In addition, a clock with very large digits displayed on a computer screen informed participants about the time remaining to complete each task.

Participants first processed two practice texts and then the ten experimental texts. The whole experiment lasted 70 minutes.

Results

Answers to comprehension questions were scored on a 2-point scale, with 0 for a wrong answer, 2 for a correct answer and 1 for a partial answer. To help reading the results, this scale was brought back to a 1-point scale. In the following, we analyze separately the two types of cohesion that were

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manipulated and then we consider the metacognitive judgment.

Relational cohesion

For each participant, we computed a mean score for each text condition (more or less cohesive) and for each type of question (manipulation tapping or not). As a reminder, manipulation tapping questions were related to a manipulated item, in this case presence or absence of a connective to mark a causal relation. The non-manipulation tapping questions covered different matters in the text. Mean scores across participants for these four conditions are shown in Table 1. An analysis of variance, using text condition and type of question as within factors, was performed. There was a highly significant effect of the text condition ($F(1,52)=15.48$, $p=0.0002$, $\eta^2=0.08$). Contrary to Millis et al.'s results, texts with (adequate) connectives lead to a better comprehension performance than texts without connectives. It is noteworthy that all six texts showed an advantage for the cohesive version.

The difference between the two types of questions was not significant ($F<1$). This means that participants did not score significantly worse or better on the manipulation tapping questions than on the other questions.

The interaction between text condition and type of question is almost significant ($F(1,52)=3.92$, $p=0.0530$, $\eta^2=0.01$). Although the data in Table 1 seem to suggest that the cohesive manipulation affected only the manipulation tapping questions, this was not the case. This is confirmed by a paired t-test comparing the two text conditions with the non-manipulation tapping question condition which was significant ($t(53)=2.05$, $p<0.0451$). It follows that the cohesive manipulation affected the questions about the relation signaled by the connective, as well as the questions covering other parts of the text.

Insert Table 1 about here

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Referential cohesion

Data were analyzed as explained above for the relational cohesion. There was a significant effect of the text condition ($F(1,52)=7.13$, $p=0.0101$, $\eta^2=0.02$). As expected, less cohesive texts are harder to understand. There was also a significant effect of the type of questions ($F(1,52)=9.33$, $p=0.0035$, $\eta^2=0.03$). Mean scores for the manipulation tapping questions indicate that these were harder to resolve than the non-manipulation tapping questions. Finally, the interaction between text condition and type of question was not significant ($F(1,52)=2.52$, $p>0.10$, power for detecting an effect size of 0.03 (Levin's ω^2 , 1997, p. 100) is approximately 0.70), even though the cohesive manipulation seems to have a stronger effect on the manipulation tapping questions than on the non-manipulating ones.

Insert Table 2 about here

Meta-judgment

These analyses focus on the meta-comprehension question in which participants estimated the number of questions they would answer correctly before seeing these comprehension questions. Here too, the answers were brought back to a 1-point scale. But, prior to considering the impact of the cohesive manipulation on the meta-judgment, we have to be sure that the participants have indeed been able to formulate meaningful meta-judgments. To this end, we checked whether the meta-comprehension judgments were significant predictors of the comprehension scores throughout the different texts. This relation was calculated by computing for each participant a linear regression with the meta-comprehension judgment as the predictor and the comprehension score as the dependent variable, using as cases each of the ten experimental texts. Although the relation was quite moderate (mean Pearson's r of 0.20), mean beta value across participants was significantly

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different from 0 (Beta = 0.11, $t(52)=3.24$, $p=0.0021$). It follows from this that participants were indeed able to estimate their understanding before answering the questions.

Insert Table 3 about here

Table 3 presents the readers' mean estimates for each text condition as well as their mean performance on comprehension. An Anova contrasting the two text conditions (less cohesive or more cohesive) and the two measures (comprehension score and metajudgment) for the relational cohesion manipulation shows a significant interaction ($F(1,52)=8.70$; $p=0.0048$; $\eta^2=0.02$). The same analysis produces the same result for the referential cohesion manipulation ($F(1,52)=5.62$; $p=0.0215$; $\eta^2=0.01$). As one can see in Table 3, participants were on average quite accurate in estimating the number of questions they would answer correctly in the less cohesive text condition. There was, however, an important discrepancy between the estimates and the actual performance for the more cohesive texts both for the relational and the referential manipulations. Readers underestimate their comprehension performance when they judge the more cohesive versions. This result is in complete contradiction with the passivity hypothesis. It follows from this that the readers' estimates confirm the conclusions drawn from their comprehension performances: the presence of adequate connectives and anaphors improves the readers' comprehension and does not lead them to produce less cognitive effort to integrate the text.

Table 3 also shows that there was no effect of the text condition on the meta-comprehension judgments (all $F_s < 1$). We may conclude from this that the manipulation of our texts did not affect the readers' feeling of understanding and consequently that they did not find that the less cohesive version was less comprehensive than the more cohesive one.

DISCUSSION

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Understanding an informative text consists of building a coherent mental representation in which new information presented in the text is related to the reader's prior knowledge. The goal of a writer, then, is that the reader builds the mental representation she wants to convey (Britton, 1994). This implies that the reader activates different pieces of information and establishes relations between them. These pieces of information and the relations between them can be explicit in the text. They may also be left implicit in which case the reader has to rely on his prior knowledge. The main difficulty of the writer then lies in deciding how and which piece of information to provide to the reader: sufficient but not too much, so that the reader *can* build a coherent mental representation without being encumbered with already known information. In other words, the writer should apply the Gricean conversational maxim of quantity to text writing.

The basic question to the research presented here concerns the need for linguistic signals to establish relational coherence. Are they necessary or is it preferable not to mention them? Recent work seems to indicate that the writer is not always better off being as explicit as possible using connectives to signal relational coherence (Millis et al., 1993). Such a conclusion could have heavy consequences for professional writers and other people involved in text and document design.

We investigated the plausibility of this conclusion using natural-like informative texts while manipulating linguistically adequate connectives. Clearly, our results do not agree with those of Millis and colleagues. Connectives significantly improve comprehension. In addition, the relational markers affect both the manipulated relations they signal and the other parts of the text. This leads us to the conclusion that relational marking plays a crucial role in the global mental representation constructed by the reader. Lack of signaling seems indeed to lead to a disturbed (or less well constructed) mental representation, since comprehension of other parts of the text is also affected. In addition, this effect was replicated in another independent experiment investigating the impact of discourse markers on L1 and L2 readers (Degand & Sanders, in prep.).

The question that arises now is why our results are so diverging from prior results. We believe

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that the main explanation lies in the type of texts and the quality of the manipulation. Only adequate connectives were used, i.e. connectives compatible with the underlying (causal) coherence relation. This is an important theoretical standpoint: causal connectives cannot be used to *force* a causal reading, they can merely be used to *make explicit* an underlying causal relation. Only then is it possible to investigate the role of this *explicitation* on text comprehension. In addition, we tried to construct experimental texts that were as natural-like as possible. This means that we did not use an overwhelming number of connectives, that we varied the type of coherence relations and markers used in the text (although only the causal relations were manipulated), and that even in the “implicit” versions some (non-manipulated) discourse markers were present. One of the conclusions we may draw from the absence of metacognitive impact on the more or less cohesive text versions is that we succeeded in this goal. Readers did not find one version less comprehensive than the other, i.e. they had the feeling that the explicit and the implicit versions read equally well.

The question that arises now is to what extent these results can be generalized. Is it the case that linguistic marking of coherence relations always leads to better comprehension? Previous findings in the literature do not suggest this. In particular, it seems that the reader’s level of expertise should be taken into account. McNamara and Kintsch (1996) have shown that high level experts benefit more from low cohesive texts than from high cohesive ones. In our experiment, the topics of our experimental texts were selected in such a way that they did not require any previous knowledge. In our opinion, this is the case for most public information texts. Hence, we believe that these types of texts deserve special attention as to their formal improvement by means of markers. This is the more important since Traxler and Gernsbacher (1995) and Britton (1994) have observed that authors frequently overestimate the knowledge of their readers and as a consequence do not introduce the necessary markers. Of course, this means that we would know exactly how the different linguistic signals interact in improving text comprehension. Clearly, connectives seem to play a role, and their role is different from referential marking. But what about the interaction

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between referential and relational coherence? What about the impact of other linguistic signals such as headings, previews, and other types of relational markers? The length of the texts is another factor we should take into account. Natural texts are usually longer than 200 words, however the impact of signaling on longer texts remains largely to be investigated. It is our belief that the findings of further reading research can give rise to text writing advice and hence lead to the improvement of texts.

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Appendix

“More cohesive-connective” text

Aucun autre insecte piqueur n'est aussi redouté dans les régions forestières du centre du Canada que les mouches noires ou simulies. En été et en automne, ces mouches peuvent y être si abondantes que les activités de plein air deviennent pratiquement impossibles. La majorité d'entre elles ne piquent pas, car une dégénérescence des pièces buccales ne leur permet que de se nourrir du nectar des fleurs. Toutefois, leur présence constante et leur bourdonnement sont particulièrement agaçants. Parmi les nombreuses espèces de simulies, deux sont tout particulièrement nuisibles. Au début de l'été, ce sont surtout les simulies "venustum" qui sont les plus agressives. Durant cette période de l'année, les simulies "decorum" passent inaperçues parce que les autres espèces sont beaucoup plus nombreuses. En automne, elles deviennent particulièrement agressives. La seule solution face à ce fléau est de se protéger. Il est beaucoup plus sage de porter une chemise de couleur pâle parce que les simulies sont davantage attirées par les teintes foncées. Toutefois, il est très important d'éloigner les mouches de la région de la tête. Donc, les jeans foncés sont parfois préférables aux pantalons pâles pourvu qu'ils soient sans trous.

(based on the article “ Les mouches noires ou simulies ” found on the “Research Branch Server” of “Agriculture and Agri-food Canada” at URL:

http://res.agr.ca/PUB/ecorc/program2/entomology/biting_flies/french/flies11f.html)

Related questions :

Pourquoi la plupart des Simulies ne sont-elles pas dangereuses ?

Comment peut-on expliquer que les Simulies “ decorum ” passent inaperçues en été ?

Dans quelles régions du Canada les mouches sont-elles les plus gênantes ?

Dans les régions infestées de mouches, pourquoi y a-t-il un intérêt à porter un jeans foncé en été ?

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“Less cohesive-anaphoric” text

La gymnastique a été fondée par un suédois à la fin du dix-huitième siècle. Il s’agissait à l’époque d’une méthode très particulière exigeant des mouvements établis selon les lois de l’organisme. Le succès fut immédiat car elle avait comme objectif le développement harmonieux de la silhouette. **II** ne dura cependant pas, victime de nombreuses critiques à propos du trop grand statisme de cette discipline. Diverses autres méthodes furent proposées fin du dix-neuvième siècle, mais ce n’est qu’en 1936 que la gymnastique devint un sport à part entière. Si auparavant la qualité principale des gymnaste était la force, l’accent fut de plus en plus mis sur la vitesse grâce à la technique de l’élan. L’évolution de la gymnastique rythmique est une bonne illustration de cette métamorphose. **II** a permis la réalisation d’exercices plus audacieux et plus artistiques. Par ailleurs, la reconnaissance de la gymnastique comme discipline olympique impliqua la mise au point d’un système de pointage universel. Dans chacune des compétitions, on peut maintenant trouver un exercice libre ainsi qu’un exercice imposé. On l’applique afin de pouvoir juger l’originalité et la rigueur des mouvements de chaque gymnaste.

Table 1: Mean comprehension score for relational coherence with text condition and question type as a function

	More cohesive	Less cohesive
Manipulation tapping	0.74	0.60
Non-manipulation tapping	0.71	0.64

Table 2: Mean comprehension score for referential coherence with text condition and question type as a function

	More cohesive	Less cohesive
Manipulation tapping	0.72	0.59
Non-manipulation tapping	0.75	0.73

Table 3: Mean score at the comprehension and meta-comprehension questions with type of cohesion and text condition as a function

	Relational		Referential	
	Comprehension	Metajudgment	Comprehension	Metajudgment
More cohesive	0.72	0.62	0.73	0.65
Less cohesive	0.62	0.60	0.66	0.65