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Working Memory Capacity and L2 University Students' Comprehension of Linear Texts and Hypertexts

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ABSTRACT

The aim of this study was to investigate the relationship between working memory capacity and L2 reading comprehension of both linear texts and hypertexts. Three different instruments were used to measure comprehension (recall, comprehension questions and perception of contradictions) and the Reading Span Test (Daneman & Carpenter, 1980) was used as a measure of working memory capacity. Forty-two speakers of English as an L2 from two different L1 backgrounds (21 Brazilians and 21 Chinese) participated in the study. The results obtained signal to the fact that hypertexts might compromise comprehension, especially for low-span participants. The broad conclusion achieved in this study is that different variables including readers' working memory capacity, their first language, and the mode of text presentation may interfere in L2 reading, and each one of these aspects might hamper, in different ways, the construction of a coherent mental representation of the text being read.

KEYWORDS: L2 Reading Comprehension, Working Memory Capacity, Linear Texts, Hypertexts.

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I. INTRODUCTION

Reading is a complex activity, comprising a composite of cognitive phenomena required for achieving comprehension. As they read, readers have to create a mental representation of the text's content, which has to be revised and updated appropriately as reading unfolds, in order to ensure coherent meaning construction (Kintsch & van Dijk, 1978; Lehman & Schraw, 2002; van Oostendorp & Bonebakker, 1999).

Expert first language readers may process reading information automatically, and effortlessly, unless the text imposes some burden for processing due to factors such as the reader's lack of familiarity with the rhetorical organization of the text or with the words used to convey the information (Tomitch, 2003), for example. L2 reading, on the other hand, can impose an additional burden on the reader, taking into account that different variables can affect the process, for example: the reader's cultural background knowledge, the level of proficiency he/she has in the L2, and the degree of difference between the orthographic system of the L1 and the L2, among other factors. The more constraints the reading imposes, the more working memory capacity is required for processing, considering that text processing happens within a limited capacity working memory system (Engle, Cantor & Carullo, 1992; Just & Carpenter, 1992; Tomitch, 2003).

Working memory is understood here as a limited capacity system, with extremely transient duration, responsible for processing on line information, varying its capacity from individual to individual and having a direct influence in the way information is processed, stored, and retrieved (Daneman & Carpenter, 1980; Fontanini, 2007; Fortkamp, 2000; Just & Carpenter, 1992; Kintsch & van Dijk, 1978; Miyake, Just & Carpenter, 1994; Tomitch, 2003; Turner & Engle, 1989). In other words, it could be stated that working memory is an important performance constrainer in reading activity, especially in L2 reading where different variables, as stated above, may play a role in the achievement of comprehension.

Another important aspect to be considered in relation to reading is whether different modes of text presentation may impose a burden for processing and influence in the construction of a coherent mental representation. The growth in the use of hypertexts brought researchers to investigate their nature as possible constraint for processing and comprehension, due to their non-linearity, in contrast to the linear organization of traditional texts (Aarseth, 1994; Foltz, 1996; Leu & Reinking, 1996; McKnight, 1996; McKnight, Dillon & Richardson, 1991; van Oostendorp & Mul, 1996). In other words, considering that the linear organization of texts may lead to the establishment of the possible semantic relations

faster and clearer, which may, in turn, facilitate processing, researchers started to study the effects of the fragmented nature of hypertext, compared to the linear ones, for reaching comprehension. Different standpoints can be found in the literature about the effects nonlinear texts can have on processing and achieving coherence and thus, on building an accurate mental representation of the content of the text (Charney, 1994, McKnight, Dillon & Richardson, 1993; Dillon, 1996; Smith, 1994).

Based on the discussion above, the aim of the present study[1] was to investigate the relationship between working memory capacity and L2 reading comprehension of both linear texts and hypertexts. The study pursued answers to the following questions:

1) In which mode of text presentation, hypertext or linear text, do readers of English as an L2 recall more propositions?
2) In which mode of text presentation, hypertext or linear text, do participants show higher performance in comprehension?
3) What is the relationship between participants' working memory capacity and their performance in relation to comprehension and recall of both hypertexts and linear texts?
4) In which mode of text presentation, hypertext or linear text, do participants notice more contradictions?

Answers to the four research questions above were sought using two groups of readers of English as an L2 with different L1 backgrounds, one group of Brazilian speakers of Portuguese and another of Chinese. This design enabled us to investigate whether there could be possible differences in the performance of the two groups (L1 interference) when reading in L2.

II. METHOD

II.1. Participants

Forty-two university students, readers of English as an L2, participated in the study, being seventeen males and twenty-five females. Their recruitment was done in two different countries: Brazil and the United Kingdom. In Brazil, fifteen were from the Federal University of Santa Catarina (Universidade Federal de Santa Catarina- UFSC), and six were from a language institute (Instituto de Línguas- ILG), from the State University of Maringá

(Universidade Estadual de Maringá- UEM), in the state of Paraná. All the participants from UFSC were taking their M.A in English. Participants from ILG-UEM were all English teachers, three of them with M.A. degrees in English. This entire group was made up of Brazilian speakers of Portuguese, English being their second language. They were all recruited personally by the first author of this study, who explained to them, in very general terms, the objective of the study and the importance of their contribution.

Volunteers from the United Kingdom were all Chinese, ESL[2] (English as a second language) speakers as well, and students from Loughborough University. These participants were recruited by e-mail, and also received general information about the aim of study and the importance of their participation. The 21 participants in this group were also taking their M.A, six being from the Information Science Department, and fifteen from the Business Department. Each participant in this group received 15 pounds, as book tokens, for their participation in the study, provided by the Information Science Department from Loughborough University.

In order to ensure participants' privacy, in this study they are addressed according to their order of participation as Participant 01, Participant 02, and so on. Participants from 01 to 21 are all Brazilians, and those from 22 to 42 are all Chinese.

II. 2. Reading ability measures

In order to qualify for this study, participants were required to have good knowledge of the English language in relation to reading, that is, their English should not represent any constraint for understanding the texts proposed. In order to control for this variable, the following criterion was established: participants should have the IELTS certificate, or take an English test especially designed for this study. The test designed resembled that of the reading section provided in the IELTS exam. This procedure was followed taking into account that participants who did not have the IELTS would have to pay for it, which could represent a restraining factor for the recruitment of volunteers.

II.3. The linear texts and the hypertexts

In the present study, information from two expository articles was adapted for the creation of two new texts. The first original article entitled "Why are we so fat?" was taken from the National Geographic Magazine (August, 2004), and the second one entitled "Gastrointestinal Surgery for Severe Obesity" was taken from the website by The National

Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) (http://www.niddk.nih.gov/health/nutrit/pubs/gastri/gastricsurgery.htm). These two articles talk about eating disorders (Text 1) and obesity (Text 2), and both texts discuss causes and consequences, and explain what can be done to control and prevent such conditions.

The criteria for selecting the articles were the following: (1) the subject matter was considered to be of general interest for the potential participants, (2) the two texts shared similar subjects, (3) they were authentic passages, (4) they did not require specific background knowledge on the subject to understand their contents, (5) both texts presented scientific explanatory arguments, and finally (6) they were both expository. The adaptations of the two texts consisted of the preservation of some important information provided by the two original articles, and additionally, the creation of fictional characters, places and events specially idealized for the purpose of this investigation, mainly in relation to creating contradictions in the texts (to be described below).

The choice of the two texts to be used in the present study was a crucial procedure considering that at the same time that two different texts had to be used, to be presented as both linear and nonlinear (hypertext), it was imperative to try to have the text contents raising similar levels of interest; in other words, the topics should be likely appealing to the participants. The way found to overcome this problem was to present texts discussing similar subjects.

The selection of the topics in the two texts also required special control in relation to the level of background knowledge necessary for understanding them. In other words, the subjects discussed in the articles should be interesting and new enough to motivate the participants; yet, they should not compromise participants'comprehension in case their familiarity with the content was limited. This problem was circumvented by choosing a general interest subject that was present in the media at the time.

Expository texts were chosen for this study for two main reasons: first, they have not been used in cognitive studies of reading comprehension as often as narratives; and second, they seem to be more cognitively challenging for comprehension considering that the information presented is not so tightly organized as in narratives. For narratives, readers tend to possess adequate strategies guiding them in selecting and organizing information into an episodic sequence (Carrell, 1988; Graesser, 1981; Meyer, 1984), whereas for expository texts the same does not happen, because the structure tends to be looser. Previous studies in the area of working memory capacity suggest that differences in relation to capacity become more

apparent when the task at hand is cognitively demanding (Just & Carpenter, 1992; Tomitch, 2003;).

The two adapted texts were called Text 1 and Text 2, and each of them was designed to be presented as a hypertext and as a linear text. In both texts, the general main idea was provided in the first paragraph, followed by some supporting information about the topic. This feature can make reading smoother once it helps readers to link the text segments more easily, which in turn may facilitate the construction of the macrostructure (Aebersold & Field, 1997; van Dijk, 1997).

Text 1 was about eating disorders, their possible causes and treatments. As a linear text it comprised the following characteristics: 911 words, with an introduction and nine related subtitles: (1) Anorexia, (2) Bulimia, (3) Binge, (4) Eating Disorders and Scientific Research, (5) Neuroendocrine System, (6) Treatment to Eating Disorder, (7) Mary, (8) Jane, (9) Support for Eating Disorders.

As a hypertext, Text 1 also comprised an introductory paragraph, which was designed to be located on the first page of a computer screen; it also contained 911 words and nine nodes corresponding to the same nine subtitles mentioned above. The nodes were planned to be accessed in two different ways: by clicking the words in the menu, which was located on the left side of the computer screen, or by clicking the red words within the hypertext.

Text 2 was about obesity, possible causes and possible treatments. As a linear text, Text 2 comprised 952 words, and contained an introduction and ten subtitles: (1) Avoiding Stress, (2) Compulsive Eating, (3) Obesity, (4) BMI, (5) Gastric Surgery, (6) Gastric Bypass Surgery, (7) A Patient, (8) Physical Activities, (9) The Pyramid, and (10) Avoiding Obesity. As in Text 1, despite the fact that the text had subtitles, it did not have a title considering that participants would have to provide its main idea after reading it and the presence of a title could make the task too easy for them.

As a hypertext, Text 2 had the following characteristics: an introduction, which was located on the first page of the computer screen, and the same ten subtitles as in the linear version, which were now transformed into ten nodes. As in text 1, the nodes could also be accessed in two different ways- by navigating through the menu, placed on the left side of the computer screen, or by clicking on the red words located within each node. All the links within the hypertexts were written in red color.

Summing up, each text (Text 1 and Text 2) was presented in two modes – as a linear text and as a hypertext. However, no participant read the same text twice; half of them read

Text 1 as a linear text and Text 2 as a hypertext, and the other half read Text 1 as a hypertext and Text 2 as a linear text.

As mentioned before, the texts were not presented with their titles and participants were asked to provide one after reading each text. However, the subtitles were preserved because they provided essential features for the texts due to the fact that (a) in the hypertexts, they should be converted into nodes, and (b) the linear versions and the hypertext versions needed to have similar characteristics.

II.4. Comprehension measures

This research comprised three instruments used to measure participants' comprehension of each linear and hypertext: free recall, a multiple- choice questionnaire, and detection of contradictions. A fourth instrument, a retrospective questionnaire (self awareness questionnaire) was used to verify participants' perception of their comprehension of the texts and to act as a support for data interpretation. The fourth instrument was considered an indirect and subjective measure of comprehension, and thus was not scored. These four instruments are described in the next subsections.

II.4.1. Free recall

As Kintsch (1998) observes, the propositions recalled after reading "make explicit those aspects of the meaning of a text that are considered most directly relevant to how people understand a text" (p.49). Therefore, scores from the propositions recalled in both the hypertext and the linear text were used as means to investigate participants' comprehension. Initially, the propositions of the two texts used in this study were classified following a scheme devised by Tomitch (2003), based on van Dijk and Kintsch (1983), where a proposition is defined as "an intentional unit corresponding to the meaning of a sentence in linguistic theory and to the conceptual representation of a sentence in a cognitive model of language comprehension" (p.112). As van Dijk and Kintsch observe, a proposition is usually composite, i.e. it consists of several other "atomic" propositions. Based on van Dijk and Kintsch's conception of atomic propositions, Tomitch (2003) created a scheme that allows the identification and counting of the propositions recalled from a text by relating them to a matrix build for the original text (see Tomitch, 2003 for a complete description of the scheme). Following this scheme, text 1 had seventy-four (74) propositions, and Text 2 had sixty-nine (69) propositions. Investigating the propositions recalled enabled us (a) to

scrutinize the meaning constructed and stored in long-term memory, as well as (b) to investigate the relationship between the amount of information recalled and participants' working memory capacity.

II.4.2. Multiple-choice questionnaire

The second comprehension measure applied in relation to the hypertexts and the linear texts comprised a comprehension questionnaire, which consisted of ten multiple-choice questions. The questions proposed tried to explore both literal comprehension (i.e. understanding information explicitly stated in the text) and inferential comprehension (i.e. being able to read between the lines and to connect information from different parts of the text for the construction of an appropriate representation of the content of the text). Each of the ten questions provided four different alternatives, with only one correct answer. For each correct answer participants received one point, reaching a maximum possible score of ten points.

II.4.3. Detection of contradictions

Being able to realize that a text contains contradictory information is considered a measure of reading comprehension, according to many researchers in the field of reading (see for example August, Flavell & Clift, 1984; Epstein, Glenberg & Bradley, 1984; Meyer, Brandt & Bluth, 1980; Tomitch, 2003; among others). As Tomitch (2003) puts it, the reasoning behind this methodology is that "readers who are not able to detect contradictions or distortions demanded from experimental conditions may also be more inclined not to see relationships among important ideas in a text, which is the usual demand in real learning from text situations" (p. 156).

Contradictions can be possibly harder to notice in hypertexts, compared to linear texts because, in hypertexts, the contradictory statements may be presented spaced out in different nodes. Considering that readers need to have both of the contradicting pieces of information available in working memory to be able to notice them (Kamas & Reder, 1995), locating contradictions in different nodes could be a constraint for processing, especially in the case of low-span L2 readers.

In this study, there were six contradictions in each of the four texts (two linear texts and two hypertexts) and they all broke textual coherence in the sense that they added information which could not be integrated in the mental representation being constructed for each text. Thus, readers´ perception of these contradictions were expected to show in the recall of the

information in the texts, and also in the answers to the retrospective questionnaire applied at the end of each text.

II.4.4. Retrospective Questionnaire

The retrospective questions comprised two activities: (a) ten statements, and (b) a question asking about the main idea of the texts. The ten statements aimed at two different purposes: (1) to scrutinize participants' awareness of their own reading process and (2) to investigate weather participants had noticed the contradictions without directly asking them so. Six of the ten statements were designed for achieving the first purpose above mentioned: "The article was easy to understand", "The article was easy to follow", "The article was easy to read" "The article was easy to remember" "The article required a lot of effort from the readers' part", and "The vocabulary was easy". These were self-evaluation sentences, and participants were asked to rate them, subjectively, using the following scale: (1) strongly disagree; (2) disagree; (3) neutral; (4) agree; (5) strongly agree.

In order to verify participants' awareness in relation to the contradictions (the second purpose), the following four statements were provided: "The article had a logical flow of ideas", "The article seemed awkward in certain places", "The article gave all the information needed to understand the text", and "The information in the article was well organized in general terms". Here participants were also asked to rate each of the statements above, subjectively, using the same scale already presented before.

The question related to the topic of the text (What is the main topic of the text?) tried to verify if participants were able to construct the main idea in both the hypertext and the linear text with the same accuracy.

II. 5. Working memory capacity measure: The Reading Span Test

In this study, a modified version of the original reading span test (Daneman & Carpenter, 1980) was applied to access participants' working memory capacity. The adaptation was created and tested by Torres (2003) in a study with ESL students, in order to avoid a possible floor effect. Daneman and Carpenter's reading span test was devised for native speakers of English and might turn out too difficult for ESL readers, the case of the participants in the present study.

Thus, according to Torres's design, the working memory span test consisted of forty-two sentences, divided in twelve sets ranging from two to five sentences: three sets of two

sentences, three of three sentences, three of four and three sets of five sentences. As Torres (2003) explains, the sentences designed were shorter and syntactically simpler than the original reading span test, taking into account that the test was idealized for L2 speakers of English. In order to control for the processing aspect of the test, Torres (2003) included a grammatical judgment (right/wrong) task for each sentence, following the methodology used by previous researchers such as Turner and Engle (1989), Harrington and Sawyer (1992) and Fortkamp (2000). This procedure was used to try to ensure that participants would actually read and process each sentence and not only memorize the last words. Interrogation marks were put at the end of each set to signal the time for readers to recall the words in the set and to make the grammatical judgment. For example, in the set below participants were expected to recall the last words 'arm' and 'ball' and to say 'right' after finishing reading the two sentences in the set:

He played all day at the park and got a sore arm

I saw a child and her father near the river playing ball

Scores for the Reading Span test were calculated as follows: for correctly answering the three sets of two sentences, participants received "2.0". For correctly answering the three sets of three sentences, participants received "3.0", and so forth. It is important to state that the sentences were presented in three sets, one at a time, starting with two sentences, reaching five. In case only two sets of sentences, out of the three, were correct, participants received 0.5. Participants were classified in three groups: (a) low-spans, with scores ranging from 0.5 to 2.0, (b) medium-spans, with scores of 2, 5, and high-spans with results ranging from 3.0 to 5.0.

III. RESULTS AND DISCUSSION

Before we answer each of the four research questions posed in this study, we would like to present the results for the working memory (WM) capacity test, the Reading Span Test. Taking into account each nationality, the results obtained on the WM span test showed that in the Brazilian group ten participants presented high working memory spans (24%), three presented medium spans, and eight participants presented low working memory spans (19%). In the Chinese group six participants presented high working memory spans (14%), four medium, and eleven participants presented low working memory spans (26%). Hence, an

unexpected finding in this study was the fact that the Brazilian group showed better performance in the WM span test, as Figure 1 below illustrates. As described in the literature (Daneman & Carpenter, 1980; Fontanini, 2007; Just & Carpenter, 1992; Tomitch, 2003; Turner & Engle, 1989; among others), during reading, the limited resources of working memory are shared between processing and storage; therefore, a possible explanation for the results in relation to the Chinese group is that they might have consumed more resources for processing the information, and consequently, had less resources left to rehearse and store the words they needed to remember. We speculate here that their first language interfered in this process. This assumption will find further support in the results presented below when we answer the research questions.

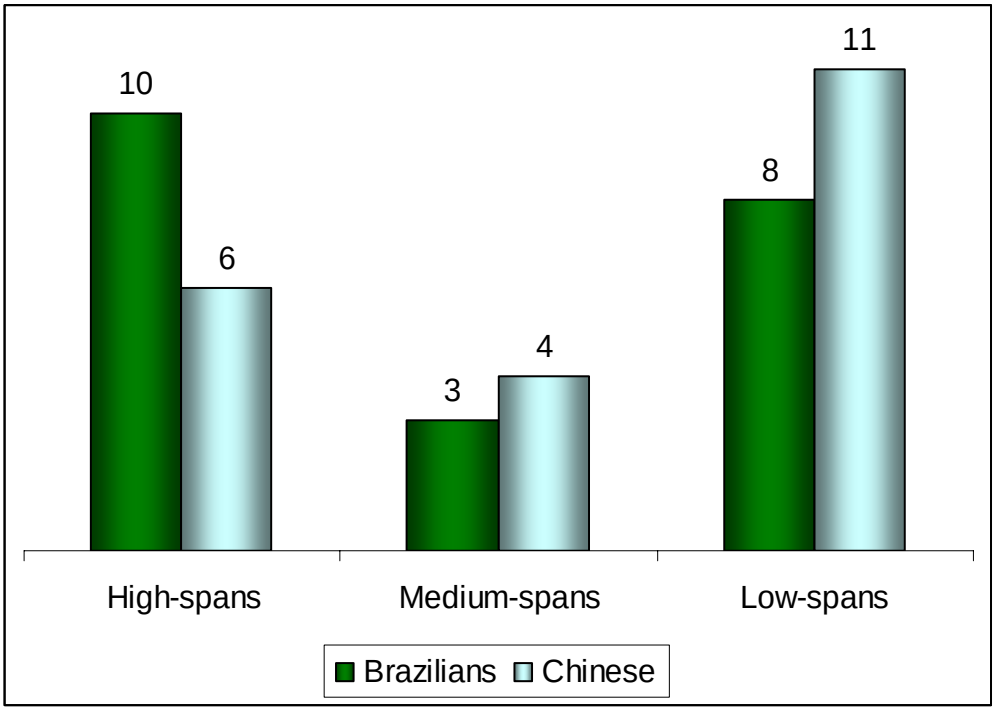

Figure 1. Working memory results in relation to nationality

Moving to the research questions posed in this study, the first one was 'In which mode of text presentation, hypertext or linear text, did participants recall more propositions?' The hypothesis here was that the recall of propositions would be higher for the linear texts as compared to hypertexts, in view that linear texts present information in a sequence, which might seem more logically and chronologically organized. Thus, information could be more promptly integrated, and coherence could be more easily achieved.

Examination considering the linear text recalls (from now on also called linear prop) between the Brazilian and Chinese group showed that there was a significant statistical difference in means between these two groups in the recall of linear propositions, favoring the Brazilian group ($t=2.66$, $p=0.01 < 0.05$). Taking into account that these two groups had the same English level required, and in addition, considering that the majority of the participants acknowledged in the retrospective questionnaire (self-evaluation questions), that the texts presented all the information necessary to understand their contents, a possible explanation for the difference in performance is that the Chinese language might have interfered in their L2 reading. Chinese sentences are mostly read from right to left, whereas Portuguese and English are both read from left to right. Accordingly, it is possible to hypothesize that for the Chinese group, reading only once was not enough for allowing them to capture, process and retain as much information as the Brazilian participants did, which in turn, limited their construction of main propositions (Kintsch, 1998). This outcome may also corroborate Brown and Hymes's (1985) finding that the literacy background affects visual and orthographic processing, which, in turn, may constrain comprehension, view which is also shared by Bernhardt (1991) and Urquhart and Weir (1998).

Comparing the two groups in relation to their performance in the hypertext recalls (from now on also called hyper prop), the outcomes showed a slight difference favoring the Brazilian group, but it did not reach statistical significance ($t=1.24$, $p=0.22 > 0.05$). Although not reaching statistical significance, another aspect should be noted in terms of the results for the recall of both linear and hypertext. As expected, the Brazilian group presented a little decrease in terms of the propositions recalled from the hypertext (linear prop: 14.57, and hyper prop: 13.14), whereas the Chinese group presented a slight increase in their performance (linear prop: 9.14, and hyper prop: 10.28). The Chinese group seemed to have benefited from the hypertext organization to construct the main ideas, slightly increasing their performance. One explanation might be the Chinese group having more experience with reading electronic texts, and since we did not ask participants specifically about this, we can only speculate. If that is the case, we might conjecture that without the timing aspect, which occurred in the WM span test, somehow the Chinese were able to use their expertise in reading electronically and slightly outperform their reading of the linear text. However, taking into account that the results did not reach statistical significance, and that we did not include a specific question about familiarity with reading electronic texts, this explanation warrants further investigation.

The second research question tried to inspect in which mode of text presentation, hypertext or linear text, participants showed higher performance in the comprehension questions. The hypothesis raised was that in linear texts information seems to be more readily available for processing, integrating, and constructing both the micro (local structure), and macro structure (global structure) of texts (Kintsch, 1998; van Dijk, 1980). Thus, scores in the comprehension questions were expected to be higher in the linear texts.

Comparing the mean scores obtained by the two groups- Brazilians and Chinese- in both the linear text and the hypertext, results showed no significant statistical difference in relation to the linear text ($t=1.67$, $df=40$, $p=0.10 > 0.05$), nor in terms of the hypertext ($t=1.00$, $df=40$, $p=0.31 > 0.05$). It could be said that the Brazilian and the Chinese participants performed alike, that is, in general, they were able to process and retain some of the specific information necessary for answering the comprehension questions from the linear texts and the hypertexts.

The third research question investigated the relationship between participants' working memory capacity and their performance in both the recall and the comprehension questions posed for the linear texts and the hypertexts. The hypothesis raised in this study was that considering the straightforward relationship existing between working memory capacity and performance (see for example, Daneman & Carpenter, 1980; Engle, Kane & Tuholsky, 1999; Fontanini, Weissheimer, Bergsleithner, Perucci, D' Ely, 2005; Just & Carpenter, 1992; Miyake & Shah, 1999; Tomitch, 1996; among others), and in addition, taking into account that hypertexts were assumed here to be more demanding for processing than linear texts, this correlation was expected to be stronger, hence more perceptible, in activities related to the hypertexts.

In terms of the results obtained, considering the two nationalities (Brazilian and Chinese), moderate positive correlations were found for both groups between the WM scores and the scores obtained in the recall of the linear texts (Brazilians $r=0.50$, $p<0.05$, and Chinese $r=0.59$, $p<0.05$), being slightly stronger for the Chinese group. Positive correlations for both groups were also found between the WM scores and the scores obtained in the recall of the hypertexts but this time the tendency for a higher correlation for the Chinese group was confirmed with a much larger difference when compared to the Brazilian group (Chinese $r= 0.74$, $p<0.05$, and Brazilians $r=0.57$, $p<0.05$), corroborating previous studies which show a greater effect of working memory capacity in times of high demand, as mentioned before, and also indicating a stronger relationship between working memory capacity and performance in the Chinese group. This result brings further support for the assumption

initially posed in this study in relation to the possible interference of the first language in the Chinese group.

In relation to the comprehension questions (linear written and hypertext written), while no significant correlation was found between WM scores and the linear written, in the two groups, (Brazilians $r=0.18$, $p>0.05$, and Chinese $r=0.40$, $p>0.05$), a moderate positive correlation was found between WM scores and the ones obtained in the hyper written (Brazilians $r=0.59$, $p<0.05$, and Chinese $r=0.54$, $p<0.05$). Accordingly, considering performance in the two groups (Brazilian and Chinese), these results seem also to indicate that whereas performance in the linear written was not related to the amount of memory resources each participant had available for processing information, performance in the hypertext was. Hence, the results in this study indicate that working memory capacity (WMC) is a crucial aspect for achieving comprehension in hypertexts, thus corroborating previous findings in the literature which have demonstrated that the more complex the task, the more memory resources are needed for executing it (Daneman & Carpenter, 1980; Engle, Kane & Tuholski, 1999; Just & Carpenter, 1992; Tomitch, 2003).

In relation to the last research question: 'In which mode of text presentation, hypertext or linear text, did participants notice more contradictions?, results show that, taking the two groups together, there was a small difference in the number of contradictions perceived between the two modes of text presentation -five in the hypertexts and seven in the linear texts, from a total of twelve in each text mode. Confirming our expectation, the small difference observed favored the linear texts. It is worth highlighting that only high-span participants in the two nationalities were able to notice the contradictions, as already expected. This result corroborates the assumption that it is very cognitively demanding to detect contradiction in texts, as Kamas and Reder (1995) claimed. According to these two authors, in order to be able to notice contradictions, readers have to maintain the different pieces of information in working memory at the same time and high-span participants have enough working memory resources to do so. High spans are capable of keeping both contradictory statements in memory, thus noticing the coherence break that happens in the mental representation that they are trying to build while processing the input information from the text (Kintsch, 1998; Kintsch & van Dijk, 1978).

We would like to close this section by presenting results obtained from the answers to the retrospective questionnaire (self-awareness questions). It is important to emphasize that these results describe major tendencies in relation to participants' subjective perception of

their behaviors while reading, not actually representing straightforward measures of these behaviors.

Comparing the results between the high-span participants for both the Brazilian and the Chinese group, it could be noticed that the most selected option in the Brazilian group was 'agree' (42 times) for both the linear texts and the hypertexts, while in the Chinese group the option 'neutral' was favored (43 times) for both modes of presentation. Hence, it seems that while the Brazilian high-span participants took a clear standpoint in relation to their reading process, the Chinese high-span did not.

Taking into consideration the results from the Brazilian and the Chinese low-span participants, again, a similar pattern as for the high-spans presented above can be found: while in the Chinese group (low-span participants) the option 'neutral' in relation to their standpoints was selected 40 times in the linear texts and 45 in the hypertexts, in the Brazilian group the same alternative (neutral) was only selected 19 times in both texts. On the other hand, while the Brazilian group selected the option 'strongly agree' 31 times in the hypertexts, the Chinese participants only selected it 11 times. Taking into account that the alternative 'neutral' suggests that the participants did not have a clear point of view in relation to the statements provided, and 'strongly agree' shows a firm conviction in relation to them, it can be suggested that the low-span participants in the Brazilian group had a better perception of their own reading process compared to the Chinese group. Overall, the results in this study indicate that the Chinese group (both high- and low-spans) may have encountered more problems while reading the texts, which, in turn, prevented them from being more assertive in relation to their answers.

Finally, in relation to the outcomes for the question: "What is the main topic of the text?" results showed that all participants, high and low spans in both groups -Brazilians and Chinese- were able to appropriately point out that one text was about "eating disorders" and the other one was about "obesity", independently of the mode of presentation (as a linear text or as a hypertext). This result points to the possibility that readers may achieve the gist of a text even when the text is not fully understood, that is, they may still be able to achieve global coherence even when local coherence is broken.

From the results obtained in this study, it could be argued that L2 reading comprehension stems from the interplay of different variables including readers' working memory capacity, the mode of text presentation, and also the readers' first language, among other factors already pointed in the literature. Each one of these factors, and also a

combination of them, can influence the achievement of comprehension in particular ways, and at dissimilar levels.

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[1] The study presented here is based on a doctoral dissertation (Fontanini, 2007) defended at the Graduate Program in English Language and Literature, at the Federal University of Santa Catarina, in Brazil.
[2] In this study ESL (English as a second language) is being used interchangeably with EFL (English as a foreign language).

