EFL speaking and individual differences in working memory capacity: grammatical complexity and weighted lexical density in the oral production of beginners

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Abstract

The present study expands on Fontanini et al. (2005) using part of a pool of data to examine the relationship between working memory capacity measured by the Speaking Span Test and Operation Span Test, and twelve beginner learners' use of grammatically complex and lexically dense speech when performing a picture description in English as an L2. Adding to the results obtained by Fontanini et al., there are no significant correlations between measures of working memory and learners' complex and lexically dense speech. Therefore, results support the existence of trade-off effects among speech production variables as a function of individual differences in working memory capacity.

Key words: L2 speech production, complexity, lexical density, working memory capacity, trade-off effects.

Introdução

The construct working memory (WM), defined as "…those mechanisms or processes that are involved in the control, regulation, and active maintenance of task-relevant information in the service of complex cognition, including novel as well as familiar, skilled tasks" (Miyake and Shah, 1999, p. 45), has been extensively researched as one of the variables impacting learners' performance on complex

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cognitive tasks, such as speaking a foreign language (FORTKAMP, 1999; 2000; MENDONÇA, 2003; FONTANINI, WEISSHEIMER, BERGSLEITHNER, PERUCCI and D'ELY, 2005; FINARDI and PREBIANCA, 2006; FINARDI, 2006; GUARÁ-TAVARES, 2005; BERGSLEITHNER, 2005; WEISSHEIMER, 2007; XHAFAJ, 2006). Overall, research results have demonstrated that individuals with larger working memory capacity (WMC) outperform those with a smaller capacity.

Although an encompassing body of research examining the relationship between WMC and the performance of cognitive tasks, particularly the nature of this relationship, has been put forward, there seems to be little research attempting to scrutinize this issue with beginners. In this sense, the present study expands on Fontanini et al. (2005) by investigating speakers' capacity of using grammatically complex language and lexically dense speech. Moreover, it aims at enriching the discussion brought by Skehan (2006) in relation to the different dimensions of speech: fluency, accuracy, complexity and lexical density. In doing so, the following research questions were pursued:

1. Is there a relationship between WMC, as measured by the Speaking Span Test (SST) in L2, and L2 speech production in terms of complexity and weighted lexical density?
2. Is there a relationship between WMC, as measured by the Operation Span Test (OSpan) in L2, and L2 speech production in terms of complexity and weighted lexical density?

From the aforementioned research questions, two hypotheses were generated:

- Hypothesis 1: There is a statistically significant correlation between WMC, as measured by the SST in L2 (strict and lenient scores), and complex and lexically dense L2 speech.
- Hypothesis 2: There is a statistically significant correlation between WMC, as measured by the OSpan in L2, and complex and lexically dense L2 speech.

This article is organized in five main sections. Right after this introductory section, we give an overview of the concept of working memory from the information processing theory perspective and its relationship to studies on individual differences in performance in section 2. In the third section, some studies concerning the relationship between working memory capacity and L2 speech production are reported. The forth section describes the method, participants, procedures for data collection and analysis and, the results obtained. Finally, in section five, we discuss the results and present some final remarks regarding limitations of the study and suggestions for future research.

INDIVIDUAL DIFFERENCES IN WORKING MEMORY CAPACITY

Although there are several models in the attempt to unveil the construct working memory (see MYAKE and SHAW, 1999 for an extensive review), for the purposes of the present small scale research only two models will be briefly reviewed – Baddeley and Hitch (1974), and Engle et al. (1999) due to the fact that the former introduced this construct in the realm of cognitive psychology, and the later postulates that working memory resources are attentional, which is the perspective taken by the researchers.

As regards Baddeley and Hitch (1974) model, working memory is comprised by a supervisory system – the central executive, and by two specialized slave systems – the phonological loop and the visual spatial sketchpad. Each of the systems are responsible for the execution of specific tasks, such as the case of the central executive which coordinates the slave systems, controls attention, activates information from long-term memory and is responsible for storage functions. As regards the phonological loop, it caters for the storage and manipulation of speech-based information, and the visual sketchpad is responsible for controlling visual and/or spatial material. This model has been expanded, and Baddley (2000) proposed a new component – the episodic buffer, which integrates information from the two slave systems and, also, from long-term memory. In this model the roles attributed to working memory vary from retrieval of relevant knowledge already stored in long term memory, to manipulation and recombination of material, which will result in encoding the results of previous operations in long-term memory (BADDELEY and LOGIE, 1999). From Baddeley's perspective, working memory is a limited multi-dimensional system and the bulk of research conducted under this perspective is interested in describing its different components.

Departing from empirical evidence that differences in working memory can be attributed to human's ability to control attention, Engle and his associates take the view that working memory is a cognitive unitary system which encompasses a store in the form of long-term memory traces active above a threshold, the processes responsible for achieving and maintaining this activation, and the control of attention. Thus, the construct working memory capacity is not to be solely equated to storage, and only refers to what Baddeley (1974) has named as the central executive system as it has to do with "the capacity for controlled sustained attention in the face of interference" (ENGLE et al., 1999, p. 104). This means that when facing complex cognitive tasks in which control is required, it is the capacity for sustaining, maintaining and shifting attention among the different task's requirements, and also the ability to maintain or inhibit irrelevant information which will play a role in determining individual differences.

Therefore, the perspective we take towards working memory is the one that views this construct as a limited attentional resource, which could be also named as 'working attention' (BADDELEY and LOGIE, 1999, in FORTKAMP, 2000, p. 165), thus, being in line with the role assigned to the central executive by Baddeley and Hitch (1974).

WMC AND SPEECH PRODUCTION

Departing from the assumption that working memory plays a decisive role in the performance of highly demanding cognitive tasks such as speaking, both in L1 and L2 (see LEVELT, 1989; GREEN, 1986, Miyake and Shah, 1999, for instance) there has been attempts to investigate whether WMC can account for individual differences in verbal fluency (Daneman, 1991; Fortkamp, 1999; 2000, among others).

Daneman (1991) claimed that, likewise reading comprehension, speech production is also a complex cognitive task implying storage and process of information, being possibly affected by individual differences. Her assumption was that individuals with a larger WMC would be more fluent speakers than those with a smaller capacity. In order to test this hypothesis, Daneman measured speakers' WMC through the Speaking Span Test (SST) (Daneman and Green, 1986). Results showed that measures of the SST and measures of fluency correlated significantly, thus indicating that more fluent speakers had a larger WMC.

Tracking the claims made by Daneman (1991), Fortkamp (1999) investigated whether WMC would correlate to fluent L2 speech, by replicating Daneman's study. The measures to assess WMC were the SST and the RST, both in L1 (Portuguese) and L2 (English); and the measures to assess fluency were the Speaking Generation Task (SGT), the Oral Slip Task (OST) and the Oral Reading Task (ORT). Results showed no significant correlations between the SST in L1 and in L2, neither between the SST and the RST in both languages. However, the SST in L2 correlated significantly with the SGT, indicating that larger WMC corresponds to faster speech rate. In sum, the findings of Fortkamp's study give partial support to the task-specific view of WM and suggest that speakers seem to draw on different pools of cognitive resources when L1 and L2 speech are to be produced.

Another relevant study to the field of WM research and speech production is Fortkamp (2000). In this study, the researcher investigated individual differences in WMC and its relationship to the production of fluent, accurate, complex and lexical dense L2 speech. In order to measure WMC a SST was used (Daneman, 1991) and a picture description task and a narrative task were the instruments to elicit participants' speech production. Results showed a significant positive correlation between individuals' WMC and fluency, accuracy and complexity. However, against her hypothesis, a negative statistically significant correlation was found between WMC and weighted lexical density, indicating that individuals with higher WMC produced less lexically dense speech. Finally, she suggested that fluency, accuracy, complexity and lexical density are related to the processes occurring within the Grammatical Encoder component (LEVELT, 1989) thus, claiming that WM is related to speech production at the formulation level.

Mendonça (2003) sets out to investigate WMC and its relationship to the retention of L2 vocabulary. WMC was measured by the SST (DANEMAN,1991) and vocabulary retention was assessed by a narrative task in which participants had to recall and use the words previously taught by the researcher herself (productive task) and, by a receptive task in which participants were asked to either translate or define the learned words. Moreover, the study also aimed at unfolding the strategies participants used to retain vocabulary and correlating them with their WMC. Results revealed that WMC correlated significantly with vocabulary retention scores on both productive and receptive tasks, indicating that higher-span participants were better at learning and using new words. In addition, results showed that high spans did not make use of any specific strategy to acquire vocabulary.

More recently, Fontanini et al. (2005) looked at the relationship between WMC and L2 performance in various domains, one of which was speech production. In this study, participants were allowed 10 minutes of strategic planning before performing the speaking task. Surprisingly, despite using the same WMC measures used by Fortkamp (2000), Fontanini et al. (2005) did not find significant correlations between WMC and fluency. The researchers concluded that the lack of correlation might be accounted for the fact that (i) speech rate alone was not enough to capture all processes involved in the performance of fluent speech, (ii) there are trade-off effects operating among different aspects of L2 speech performance, thus competing for the limited attentional resources of the WM system and, (iii) the speaking span test used to measure participants' WMC did not take into consideration the time component intrinsically embedded in the nature fluent speech (as measured by speech rate: total number of words divided by total time spoken in seconds and multiplied by 100), and (iv) time for strategic planning might have minimized differences in WMC.

Guará-Tavares (2005), under a product-process perspective investigated the relationship between learners' WMC, strategic planning processes and learners' oral performance. As regards the relationship between WMC and intermediate learners' oral performance, in the non-planning condition, participants with higher WMC were less prone to making mistakes. Concerning fluency, learners WMC did not correlate with learners' rate of speech. This result does not corroborate those of Fortkamp (2000) who scrutinized the fluency phenomena under a variety of measures. However, it goes in line with Fontanini et al.'s research findings. Based on this result, both Guará-Tavares (2005) and Fontanini et al.(2005), and in the light of Fortkamp's (2000) results, suggest that speech rate might be too general a measure of fluency and, thus, fluent performance should be also assessed by other indices (silent pauses, filled pauses, self-repair, for instance) as well for differences in performance to emerge. Focusing on the outcomes of learners' planned performance, no significant correlation was noticed between learners' WMC and fluent and accurate performance. As also suggested by Fontanini et al. (2005), Guará-Tavares (2005) claims that strategic planning might have minimized individual differences in WMC.

Bergsleithner (2007) examined the relationship among WMC, noticing of L2 forms and accurate L2 speech. Results indicated that individuals with a higher WMC were better at noticing formal aspects of the language and, thus, performed more accurately. Finardi and Prebianca (2006) also found a significant statistical correlation between WMC and fluent L2 speech as measured by number of words per minute. Xhafaj (2006) corroborated Finardi and Prebianca's findings (2006) using a different measure of fluency – the use of pause patterns in L2 speech. Weissheimer (2007) set out to investigate whether intermediate learners' WMC would improve as a result of speech proficiency development. Overall results showed that both higher and lower spans improved on speech production measures, but only lower spans had their WMC affected by that.

As evidenced by the aforementioned studies, it seems that the relationship between WM and L2 speech is a complex one, especially, due to the fact that working memory does not affect systematically the different dimension of L2 speech (fluency, accuracy, complexity and lexical density). Moreover, there seems to be other variables mediating research results such as learners' proficiency level, task performance conditions (for instance, planning versus non-planning time), task complexity (here-and-now versus there-and-then tasks), and lack of uniformity in the operationalization of measures to assess the different dimensions of speech performance. Hence, caution should be exercised when taking the findings of theses studies into consideration.

METHOD

Participants

Twelve undergraduate students of the second semester of the Letras Program of a university in the south of Brazil participated in this study. There were 7 female and 5 male between 17 and 39 years old.

Data collection and analysis

The data used in the present study is part of a pool of data collected by Fontanini et al. (2005) in order to verify the relationship between working memory capacity and individual performance on L2 tasks. Although several other data collection procedures were used by Fontanini et al. (i.e. the syntactic span, reading, syntactic and phonological tasks), the present study, given its main objective, focused on data from the Speaking Span Test (SST), the Operation Span Test (OSpan) and from the picture description here-and-now task.

4.2.1 Measures of Working Memory Capacity

4.2.1.1 The Operation Word Span Test

According to Fontanini et al. (2005), the OSpan test used consisted of 60 operation strings and 60 English words, following Turner and Engle (1989). Each operation string was followed by a one- or two-syllable word and presented one at a time on the middle of a computer screen. These strings were organized in sets of two, three, four, five and six. Participants were required to calculate the result of the mathematical operations while trying to retain the word following the string for subsequent recall. At the end of this procedure, a blank screen would signal the end of the set and participants were required to recall the words in the exact form and order they were previously presented. Participants' individual spans were calculated by counting the total number of words correctly recalled for all sets; following Engle et al. (1992) (see Appendix A for the OSpan design).

4.2.1.2 The Speaking Span Test

The speaking span test used in Fontanini et al. (2005) study was based on Daneman (1991) and Fortkamp (2000) and consisted of 120 unrelated words (60 words in the training session and 60 in the testing session) presented to participants in six sets of two, three, four, five and six words each. Each word would appear individually in the middle of the computer screen for one second. Participants were required to read the word silently and try to memorize them for further recall. After ten milliseconds the next word of the set would appear and the procedure would be repeated until the set was finished. At the end of the set, a blank screen with questions marks would signal the numbers of words participants were expected to recall and consequently, the number of sentences that should be produced. To produce these sentences, participants were instructed to use the words in the correct order and form they had been presented. There were no constraints regarding the complexity and/or the size of the sentences, however, only semantically and syntactically acceptable English sentences were counted. After having produced the sentences for that set of words, the participant or the researcher would press enter in the computer keyboard so as to start the new set. Participants' individual spans were determined, as explained by Fontanini et al. (2005), according to the total number of words for which the participant was able to produce a grammatical sentence using the word previously memorized (see Appendix B for the SST design).

Measures of L2 speech production

As described by Fontanini et al. (2005), the speaking task used to elicit L2 oral production was a picture description. This task was chose because it has been widely used to elicit oral speech and due to its monologic characteristics, being thus adequate to collect data to analyze individual performance.

To perform this task, participants were provided with a colorful picture portraying a family having breakfast. Besides being instructed to describe the picture in terms of setting, people's physical characteristics, possible ages, names, occupations, and the action these people were performing, participants were also required to use their background knowledge to fulfill any information gap they might felt necessary and to express their personal opinion about the message being conveyed by the picture. Participants were allowed ten minutes to plan what to say and could also take notes during this time. However, when performing the task, participants could not use their notes, but were allowed to look at the picture while describing it (a here-and-now task).

Participants' L2 speech production was assessed in terms of complexity and weighted lexical density. For the sake of the present study, complexity is defined as learners' willingness to make use of more complex language structures, by taking risks and testing new hypothesis (Skehan and Foster, 2001) and was operationalized as the total number of subordinate clauses per a hundred words (Skehan, 1996) and was calculated according to the following formula:

$$\text{Complexity} = \frac{\text{subordinate clauses}}{\text{total words}} \times 100$$

As regard to weighted lexical density, it was calculated taking into account the total number of linguistic items produced by the speakers and the proportion of frequent and infrequent grammatical and lexical words in their speech. Following O'Loughlin (1995), Fortkamp (2000) and Fontanini et al. (2005), the grammatical and lexical items were classified according to the following criteria:

- Grammatical items: modals and auxiliaries, determiners (articles, demonstratives, possessive adjectives, quantifiers and numerals), pronouns, interrogative adverbs (what, when, how) and negative adverbs (not, never), contraction of pronouns and auxiliary verbs (considered one item), prepositions and conjunctions, discourse markers (but, so, and), sequencers (next, finally), particles (oh, uhm, well), lexicalized clauses (you know, I mean) and quantifiers phrases (anyway, somehow, whatever), lexical filled pauses (so, well) interjections (gosh, really, oh) and reactive tokens (OK, No!).
- Lexical items: nouns, adjectives, verbs, adverbs of time, place and manner, multiword verbs, idioms and contraction of pronouns and main verbs (counted as one single item).

In order to obtain participants' scores for this measure, a set of steps was followed:

1. Separate the linguistic items into grammatical or lexical items;
2. Classify the grammatical and lexical items as frequent or infrequent, according to the amount of occurrences of each item;
3. Sum up the total of frequent grammatical items and multiply by 0.5;
4. Sum up the total of infrequent grammatical items and multiply by 1;
5. Sum up the results of steps 4 and 5 above so as to obtain the index of grammatical items
6. Follow the same procedures (from steps 3 to 5) to calculate the index of lexical items;
7. Sum up the indexes of grammatical and lexical items in order to obtain the index of linguistic items;
8. Divide the index of lexical items by the index of linguistic items and multiply the resulting figure by 100 so as to have the percentage of weighted lexical density.

Previous to the calculations explained above (run in Microsoft Excel), participants' speech samples were run in a specialized computer software – the WORDSMITH, so as to obtain the number of occurrences of each linguistic item. To be considered an infrequent item the word should appear only once in the speaker's speech sample, otherwise it would be considered a frequent linguistic item.

The next section reports the results of the study taking into account the research questions previously stated and the set of hypotheses generated.

4.3 *Results*

This section presents the results of the statistical analysis carried out to address whether there is a relationship between WMC and L2 speech production in terms of complexity and weighted lexical density in a picture description here-and-now task. It is divided into three main subsections. The first one - 3.3.1 - reports the descriptive statistics for the SST and the OSpan; the second - 3.3.2 - presents the descriptive results for L2 speech production measures and, finally, the third subsection - 3.3.3 - brings the correlational results for the WMC and L2 speech production measures. A general discussion of the findings is given in section 3.4.

4.3.1 Descriptive Statistics for WMC measures

This subsection presents the descriptive statistical results for the working memory measures used in the present study. Table 1 reports the mean (M), standard deviation (SD) and the minimum (Min) and maximum (Max) scores for the SST – strict and lenient versions and, the OSPAN (see Appendix C for individual scores on these variables). It also displays scores for skewedness and kurtosis.

TABLE 1. DESCRIPTIVE STATISTICS FOR THE SST AND OSPAN

	SSTSTR	SSTLEN	OSPAN
M	22.08	27.33	33.17
SD	6.50	4.91	7.47
Min	13	22	18
Max	34	37	42
Skewedness	.314	.840	-1.409
Std. Error	.637	.637	.637
Kurtosis	-.521	-.168	1.076
Std. Error	1.232	1.232	1.232
N=12			

As can be seen from Table 1, participants' scores were found to be normally distributed in most of the variables. There was only one instance of skewedness concerning the variable OSPAN. Therefore, in order to correlate this variable with measures of speech production (complexity and weighted lexical density) a non-parametric test was used: Spearman's rho.

The highest possible score, as displayed by Table 1, for the speaking span test strict version was 34, with a standard deviation of 6,50. The variation between the minimum and maximum scores on this variable was a 21-point range. Differently, results on the speaking span test lenient version present a maximum of 37 and a minimum of 22 with a 15-point range difference and a standard deviation relatively lower than the score for the strict version – 4,91.

The operation span test, in turn, presents the largest degree of variability (SD) among the three variables – 7,47, which indicates that most participants' scores on this test tended to be spread across the distribution (far from the mean – 33,17), thus revealing a more heterogeneous behavior if compared to participants' behavior in the other WM tests. This variable shows a maximum of 42 and scores varying a 24-point range. In addition, a skewedness problem was found in this variable, indicating that most participants' scores were concentrated above the mean.

4.3.2 Descriptive Statistics for L2 speech production measures

This subsection depicts the descriptive statistical results for L2 speech production measures. Table 2 displays the mean (M), standard deviation (SD) and the minimum (Min) and maximum (Max) scores for complexity (COM) and weighted lexical density measures (WLD) (see Appendix D for individual scores on these variables), besides indices of skewedness and kurtosis.

Table 2. Descriptive Statistics for complexity and weighted lexical density

	COM	WLD
M	1.58	63.66
SD	2.02	4.94
Min	0	52.68
Max	7.73	69.64
Skewedness	2.958	-.955
Std. Error	.637	.637
Kurtosis	9.491	.601
Std. Error	1.232	1.232
N=12		

As can be seen in Table 2, participants' scores were found to be normally distributed in the WLD variable, but skewed in the COM variable. The WLD variable shows a mean of 63.66 and a relatively low degree of variability (SD) – 4.94, with a maximum of 69.64 varying over a 16.92 range. The COM variable, in turn, presents a mean of 1,58 and a lower standard deviation – 2,02, with raw scores varying over a 7-ponit range.

Summing up, based on the results of the descriptive statistics, two statistical procedures – the Pearson Product Moment Coefficient of Correlation (for data normally distributed) and the Spearman's rho (for variables not normally distributed) –, were applied to the data in order to answer the main research question raised by the present study: Is there a relationship between WMC and L2 speech production in terms of complexity and WLD? Results of these analyses are reported in the next sub-section.

4.3.3 Correlational Statistics – WMC versus L2 speech production

In order to address the first question of the present study, Person correlations (two-tailed)[2] were run only between the lenient and strict scores in the L2 SST and WLD, since scores on the variables of the OSpan and COM were found to be not normally distributed. Based on the empirical studies reviewed (Fortkamp, 1999, 2000; Fontanini et al., 2005) it was predicted that the participants' scores in the SST both lenient and strict would correlate positively and significantly with measures of speech production (complexity and weighted lexical density). This prediction, however, was not confirmed thus, hypothesis 1 was rejected. There was indeed a weak positive correlation between the SST scores and WLD however, none of them was even remotely significant as can be seen in Table 3. This issue will be discussed together with the results for the non-parametric correlations between WMC, Complexity (COM) and WLD.

Table 3. Pearson Product Moment Coefficient of Correlation for the SSTSTR, SSTLIN and WLD measures

	SSTSTR	WLD
SSTSTR	1	.087
SSTLEN	.860*	.433
* $p < 0.05$		

Regarding scores on the Operation Span Test (OSpan) and on COM, Spearman's rho correlations were run so as to investigate the relationship between WMC and L2 speech production in a domain-free task. This procedure was adopted because, as stated before, these variables were not normally distributed. Mirroring the results of the Pearson test between the SSTSTR, SSTLEN and WLD, none of the correlations reached significance, thus not supporting hypothesis 2, as it is depicted in Table 4.

TABLE 4. SPEARMAN'S RHO CORRELATIONS FOR THE OSPAN, COM AND WLD MEASURES

	COM	WLD
OSPAN N=12	.065	-.356
* $p < 0.05$		

4.4 *Discussion*

The results obtained from the correlational analysis show no statistically significant correlations between measures of WMC (the SST – strict and lenient versions and the OSpan) and L2 speech production in terms of COM and WLD. Therefore, the first research question – Is there a relationship between working memory capacity and L2 speech production in terms of COM and WLD? – pursued by the present study were answered negatively.

It seems that, as predicted by the literature, when operating under cognitive pressure, L2 speakers are forced to direct their limited attentional resources towards one (or some) of the goals of oral production – fluency, accuracy and complexity, in detriment of other(s) (Skehan, 1996). This claim corroborates the results of Fontanini et al. (2005), which show a significant correlation between the SST (strict) and OSpan and accuracy. It is important to remember that the pool of data used in this study is from the same participants of the study carried out by Fontanini et al. (2005). Therefore, results of the present study support the existence of trade-off effects among speech production variables as a function of individual differences in working memory capacity. That is, as learners were employing their attentional capacity to speaking accurately (without grammatical mistakes), they were left with fewer resources to devote to the production of fluent, complex and lexically dense speech.

This finding seems to be in line with the Controlled-Attention View of WMC which postulates that the nature of the individual differences in WMC relates to individuals' ability to control attention in the face of interference so that relevant information to perform the cognitive task at hand is kept active in working memory for further retrieval and processing (Turner and Engle, 1989; Conway and Engle, 1996; Kane, Beckley, Conway and Engle, 2001; Engle, 2002).

Another possible explanation for the lack of statistically significant correlations between measures of WMC and L2 speech production might be related to the task used to elicit oral speech. As explained by Skehan and Foster (2001), "the issue of cognitive difficulty of the task has important implications for our understanding of how attention is deployed during task completion" (p.188). From this perspective, Robinson (2001) claims that task demands[3] force learners to focus on specific aspects of performance. For Robinson, tasks which require learners to deal with past information and/or many different elements and that ask for support for personal opinions are likely to be more attentional, memory and reasoning consuming. Thus, it might be that learners of this study perceived the picture description task as too demanding due to the fact that they were required to process a lot of details concerning the setting (colors, furniture etc.), the people (physical characteristics, age, possible names) and the actions these people were performing, besides being asked to use their own imagination to fill in background information and, also to give their opinion about what the picture was trying to convey. Despite being allowed 10 minutes to plan their speech and having performed a here-and-now task, we may speculate that, due to the reasons describe above, learners chose to concentrate on only one aspect of performance – in this case, accuracy - so as to be able to deal with all the requirements of the task.

In addition, Robinson states that learners' perception of task demands may be a function of their affective status. In other words, learners more motivated or with higher aptitude to L2 learning may view these demands differently, consequently presenting some variation in performance. Based on this assertion, we may suggest that learners' proficiency level – in this case, beginners - and therefore, their relatively limited amount of L2 knowledge (still under development) might have contributed to their inclination to worrying about not making mistakes, since they might felt pressured by task requirements and by the intrinsic testing nature of data collection, thus concentrating their efforts to speaking accurately. Furthermore, learners' level of proficiency in itself might have prevented the production of more grammatically complex and lexically dense speech, since at this stage of interlanguage development, learners are likely to be struggling with relatively incomplete language structures and a poorer repertoire of L2 linguistic items (words).

As reported by Robinson (2001), it seems that tasks which require learners to distinguish and describe few different elements are less reasoning-consuming than tasks in which learners need to deal with a greater number of elements not so easily distinguishable, as in the case of the present study, the picture of a family having a meal and performing a variety of different actions. Thus, in order to be able of differentiate among these elements and describe each one of them, learners would need to make use of more complex connections, more sophisticated language structures and words, and more subordination (Robinson, 2001), which, regarding their level of proficiency, might not have been possible.

On the other hand, despite the lack of statistically significant correlations between WMC and WLD, results seem to show a tendency for the use of more lexically dense speech by the learners of the present study. This trend becomes clearer if we turn to participants' raw scores on weighted lexical density (Appendix D), which indicate that most learners (7 out of 12) performed above the mean (63,66). This finding might also indicate a concern with the communicative aspects of the task and the need to convey meaningful speech.

Yet, another explanation concerning the lack of correlation between different dimensions of speech performance and scores of the speaking span test might tackle the role of strategic planning and its impact on learners' oral performance. Once participants had opportunity to strategically plan their descriptions prior to performance, they had opportunity to make lexical and grammatical choices so that they could formulate their communicative intentions. By doing so, these previously activated choices were 'fresh' in learners' long term memory, thus, could be successfully retrieved and implemented during on-line performance (D'ELY, 2004). Within this line of thought, Myake and Shah (1999, p. 414) postulate that retrieval of information is one of the mechanisms (besides coding and maintenance) that are at the core of working memory, and that the ability to rapidly and accurately recover information is a function of the level of activation of a target item. Therefore, all participants irrespective of individual differences in working memory might have benefited from pre-task planning. Nevertheless, retrieving information that has been previously planned is a complex task in itself because it requires learners to maintain the previously activated information while undergoing the process of formulating the message on line. Thus, caution should be exercised in suggesting that strategic planning can minimize differences in working memory.

Finally, a possible methodological failure regarding the OSpan might have contributed to the lack of statistically significant correlations in the present study. By observing the frequency table of this variable we can notice that 9 out of 12 learners performed well in this test, with scores above the mean (33, 17), which may suggest that the test was too easy thus, being not a good tool to measure learners' storage and processing capacities.

5 FINAL REMARKS

Taking into consideration the results of the present study, the insights especially regarding task cognitive difficulty might be a fruitful terrain to be explored, particularly for pedagogical reasons. As put forward by Robinson (2001), learning may be enhanced once the cognitive demand of the task is manipulated so as to promote opportunities for hypothesis testing and interlanguage development. The Cognition Hypothesis proposed by Robinson postulates that the allocation of attentional resources by the learner is a function of the level of cognitive difficulty of the task. That is, the more cognitively difficult the task, the more attention and memory resources are consumed in the performance of the task. According to Robinson, when focusing attention on the completion (performance) of the task, learners are able to attend to input and consequently to pushed output, which in turn may lead to noticing of particular language forms, incorporation and restructuring of information in memory.

In sum, Robinson argues that some kind of learning results from the interaction of task demands, cognitive resources and performance effects through, what he calls, learning mechanisms. These mechanisms would promote learning by "(i) strengthening of instance representation in memory, important to instance theories of knowledge representation and access; (ii) proceduralization and production compilation, important to rule-based theories of skill development and automaticity and, (iii) cue-strengthening, important to connectionist approaches" (p. 305).

In the realm of classroom settings, especially regarding the issue of manipulation of attention, Skehan's and his co-researchers (ELLIS, 2005) identify strategic planning as a pedagogical tool which is applied under the rationale that availability of pre-task time may lead learners to focus on form (LONG, 1991) while planning. Thus, the concept of planning is both pedagogically and theoretically appealing because from a 'focus on form' perspective, planning may not only lessen the cognitive load of a task, but it may also lead learners to attend to formal aspects of the language while being engaged in tasks in which meaning is top priority (ORTEGA, 1999, p. 110). Bearing in mind that the systematic study of performance conditions finds its interface with second language pedagogy (ELLIS, 2005), although teachers should look at empirical insights as 'provisional specifications' (ELLIS, 1995) and according to the contexts they teach and the beliefs they have, make a critical appraisal and decide on how they may benefit from them, strategic planning becomes an appealing construct to be incorporated in daily classrooms. It seems that giving learners to plan prior to performance, making them familiar with the task of strategic planning, and providing them with opportunities to be skillful at planning are paths for the benefits of strategic planning to emerge, and, thus, impact learners' oral performance (D'ELY, 2006). In all cases there is plenty of room for teachers to orchestrate and experiment varied classroom activities.

To conclude, the present study suffered from some limitations such as the reduced number of participants, the possible methodological failure regarding the OSpan and the set of requirements imposed on learners to accomplish the oral task (picture description). Suggestions for further research would be to replicate this study and possibly Fontanini et al. (2005) with a more representative sample of L2 learners and some modifications on the OSpan and task demands. Equally interesting would be to carry out the same picture description task with different levels of proficiency in order to try to gather more evidence concerning the impact of learners' command of the language in relation to task demands upon performance. A study aiming at investigating what learners' really do when they plan and most importantly, how they feel about planning and their impressions regarding subsequent performance, might also provide interesting insights.

A FALA EM INGLÊS COMO LÍNGUA ESTRANGEIRA E AS DIFERENÇAS INDIVIDUAIS NA CAPACIDADE DE MEMÓRIA DE TRABALHO: COMPLEXIDADE GRAMATICAL E DENSIDADE LEXICAL NA PRODUÇÃO ORAL DE ALUNOS INICIANTES

RESUMO

O presente estudo expande a investigação de Fontanini et al. (2005) utilizando parte dos dados dessa pesquisa para examinar a relação entre capacidade de memória de trabalho, medida pelo teste de amplitude oral e pelo teste de amplitude geral, e o uso de fala gramaticalmente complexa e lexicalmente densa de doze alunos iniciantes ao elaborarem uma descrição de gravura em Inglês como L2. Adicionando aos resultados obtidos por Fontanini et al. (2005), não houve correlação estatisticamente significativa entres as medidas de memória de trabalho e a fala complexa e lexicalmente densa dos aprendizes. Portanto, os resultados corroboram a existência de efeito de troca de recursos atencionais (*trade-off effects*) entre variáveis da produção oral como uma função de diferenças individuais na capacidade de memória de trabalho.

PALAVRAS-CHAVE: produção oral, complexidade, densidade lexical, capacidade de memória de trabalho, efeito de troca de recursos atencionais.

NOTES

1 Although we acknowledge that there might be qualitative differences between learning a second language and acquiring a foreign language, in this paper, no distinction is made between the two approaches therefore, the terms EFL and L2 are used interchangeably.

2 The alpha level for the present study was set in 0.05 following most studies dealing with statistical procedures in social sciences and applied linguistics. A software was used to compute all statistical procedures: SPSS (Statistical Package for Social Sciences), version 10.

3 According to Robinson (2001, p. 302) "task demands are the attentional, memory and reasoning demands of tasks that increase the mental workload the learner engages in performing the task".

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APPENDIX A

Operation strings and words used in the Operation Span Test (OSpan)

Set size	1st Trial	2nd Trial	3rd Trial	4th Trial
2	3+5 = ? house	1+3 = ? fashion	5+7 = ? ring	2+1 = ? sky
	2+4 = ? beach	3+8 = ? hand	7+8 = ? pop	5+2 = ? letter
3	2+1 = ? school	2+9 = ? person	6+6 = ? watch	4+3 = ? butter
	1+6 = ? hobby	1+7 = ? time	6+9 = ? brother	5+4 = ? mission
	3+3 = ? family	4+9 = ? country	7+7 = ? film	9+4 = ? key
4	4+1 = ? team	5+8 = ? pain	6+8 = ? tie	9+8 = ? cow
	1+1 = ? night	8+9 = ? fire	9+3 = ? summer	4+2 = ? bread
	5+2 = ? friend	1+9 = ? couple	7+2 = ? apple	8+2 = ? toy
	2+6 = ? music	8+8 = ? guy	8+4 = ? nurse	7 +5 =? bomb
5	4+3 = ? snack	1+5 = ? center	9+5 = ? mother	6+2 = ? child
	7+2 = ? drug	4+7 = ? bag	4+1 = ? clock	5+1 = ? street
	2+3 = ? honey	5+9 = ? hug	7+6 = ? moon	8+7 = ? pen
	4+4 = ? light	9+9 = ? woman	8+1 = ? milk	6+3 = ? player
	5+4 = ? face	6+7 = ? chef	6+5 = ? taxi	6+1 = ? door
6	3+6 = ? coffee	1+8 = ? sales	9+2 = ? fish	3+2 = son
	1+2 = ? mother	3+9 = ? word	5+4 = ? room	9+1 = ? lion
	7+3 = ? prison	2+2 = ? aunt	6+4 = ? party	3+1 = ? kid
	8+2 = ? number	4+8 = ? cap	8+6 = ? money	5+3 = ? hell
	5+5 = ball	5+6 = ? age	7+3 = ? soccer	8+5 = ? diet
	6+4 = ? poem	7+9 = ? painter	7+4 = ? wife	9+7 = ? author

APPENDIX B

WORDS USED IN THE SPEAKING SPAN TEST (SST) IN THE TRAINING SESSION

SET SIZE	1ST TRIAL	2ND TRIAL	3RD TRIAL
2	House	People	Boss
	Beach	Earth	Island
3	School	Soccer	Tea
	Hobby	Wife	Mouth
	Family	Power	Sport
4	Team	World	Baby
	Night	Summer	Idea
	Friend	Ocean	Movie
	Music	Apple	Space
5	Snack	Ball	Gift
	Drug	Nurse	Clock
	Honey	Truck	Woman
	Light	Actress	Taxi
	Face	Room	Fish
6	Coffee	Worker	Milk
	Mother	Dress	Problem
	Prison	Head	Window
	Number	City	Lunch
	Flower	Plant	Party
	Poem	Moon	Money

APPENDIX B

WORDS USED IN THE SPEAKING SPAN TEST (SST) IN THE TESTING SESSION

SET SIZE	1ST TRIAL	2ND TRIAL	3RD TRIAL
2	Eyes	Peace	Girl
	Song	Job	Map
3	Cup	Dog	Bank
	Game	Pencil	Star
	Ice	Brother	Doctor
4	Week	Glass	Desk
	Lover	Cake	Road
	Crime	Season	Sun
	Food	Finger	Trip
5	Monkey	Boy	Rain
	Kiss	Table	Car
	Clothes	Church	Sugar
	Vase	Duck	Exam
	Novel	Phone	Page
6	Pig	Shirt	Spring
	Book	Club	Class
	Day	Egg	Name
	Police	Man	Heart
	Sister	Air	Cheese
	Hair	Cat	Agent

APPENDIX C

INDIVIDUAL SCORES ON THE SPEAKING SPAN AND OPERATION SPAN TESTS

	SST		OSPAN
PARTICIPANT	STRICT	LENIENT	
1	13	22	29
2	26	27	36
3	23	27	38
4	19	26	18
5	18	22	37
6	28	33	42
7	22	26	37
8	21	25	37
9	30	34	34
10	18	22	36
11	34	37	35
12	13	27	19

APPENDIX D

Individual scores on L2 speech production measures

Participants	Complexity	Weighted lexical density
1	1,63	65,82
2	7,73	59,23
3	0,82	61,67
4	0,98	69,64
5	1,25	52,68
6	1,61	67,28
7	0,44	68,25
8	1,07	60,76
9	2,17	65,25
10	0,64	59,62
11	0,64	65,98
12	0	67,83