

What Can Dual Task Paradigm Tell Us About Second Language Self-Monitoring Behaviour?

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This paper is part of a larger study that aims to explore second language learner self-monitoring behaviour, that is, revising utterances before and after they are produced. After reviewing and evaluating the literature on repair measures, the paper will discuss Levelt's (1989) Perceptual Loop Theory (PLT) for L1 self-monitoring and self-repair. Although this model has been assumed to apply to L2 self-monitoring and self-repairs without major changes (Kormos, 1999), research suggests that L2 self-repairs may entail variances from L1 self-repair pattern (Tavakoli, 2011). The paper will then report on a pilot study conducted to provide insight into the effect of dual task condition (performing two tasks simultaneously) on L2 self-repair (revising conceptual and/or form aspects of overt utterances). Results of the data analysis show that L2 self-monitoring appears to be more sensitive to form during the cognitively demanding task condition. In addition, participants' ability to plan and produce repairs were significantly affected when they performed under dual task condition as compared to single task condition. This paper will discuss repair typologies in previous literature, followed by presenting methods and findings of the pilot study.

1. Introduction

L2 speech production is characterised by several features including different hesitation features which are often used by researchers as observation windows into the underlying processes of speech. One of these underlying processes is self-monitoring, which is defined as revising utterances before and after they are produced (Levelt, 1989). This section highlights Levelt's Perceptual Loop Theory (Levelt, 1983; 1989; 1999) which focuses on L1 self-monitoring processes.

Perceptual Loop Theory (PLT) suggests that monitoring has three loops to inspect the end-products of the main three stages of speech production: the Conceptualiser, the Formulator, and the Articulator (Levelt, 1983). The Conceptualiser is the first stage of speech processing which is responsible for generating the purpose of the message. The outcome that emerges from this stage is the pre-verbal message which includes the conceptual structure that is passed to the next stage. The Formulator is the second stage that processes lexical, syntactic and phonological elements of the message. It results in the phonetic plan, known as internal speech, which has the necessary grammatical and phonological features (Levelt, 1989). The final stage is the Articulator, which turns the phonetic plan into auditory speech. Speech production is mainly processed through these three stages which function in a sequential way during L1 speech production.

These three stages of speech processing are inspected by three loops of monitoring which are, respectively, the conceptual, the inner, and the auditory loops (Levelt, 1989; 1993; 1999). The first two loops (conceptual and inner loops) check speech before articulation. This level of monitoring (conceptual and inner loops) leads to covert repair which cannot be observed or examined, thus we do not know what is being corrected. Covert repairs, although a very

interesting proposal, are not of interest to the current study as they are not articulated and therefore cannot be linguistically investigated.

Of close interest to the current study is the third loop (auditory loop) which checks the utterances after articulation and results in overt repairs (Levelt, 1983; 1989). Overt repair entails detecting a problem in audible utterances, therefore the flow of speech is interrupted to make corrections. In the following sections, L2 self-repair will be discussed in relation to PLT, leading to a discussion of the repair aspects employed in the present study. The study's methods and findings will then be presented.

2. Repair Typologies in Previous Literature

Various classifications of overt repairs have been employed to serve a range of purposes in psycholinguistic research, such as examining different stages of speech processing. These different classifications of repairs will now be discussed and evaluated in relation to the purpose of the present study.

Based on Levelt's (1983; 1989) model, main classes of L1 overt self-repairs hypothetically relate to the two main stages of speech processing (the Conceptualiser and the Formulator). The first type of repair indicates that there might be a problem at the Conceptualiser level, where different parts of the message need to be differently ordered. Therefore, the initial plan is abandoned before completion and a new message is articulated resulting in false starts. This category (the Conceptualiser's influence) also includes situations where the original message is correct, but the content of the message may be inappropriate, inaccurate, incoherent, ambiguous, or may need more specific information and thus the speaker reproduces the utterance more appropriately. The second type (Error-repairs) describes the speaker's attempt to correct form error while speaking, whether morphological, syntactic or phonological. This repair is produced as a result of a problem at the Formulator level and shows the speaker's attention to linguistic form. Employing these two categories is useful in investigating the underlying speech processes and self-monitoring mechanisms.

To understand how self-monitoring mechanisms function, comprehensive examination of L1 self-repairs was implemented. Three main phases of L1 self-repair have been identified and extensively examined (Levelt, 1983). These three phases are: error detection, where the erroneous output is detected; the editing phase which usually entails producing pause/s; and the repair proper phase (i.e. producing correction) (Levelt, 1989), see See Figure 1, below:.

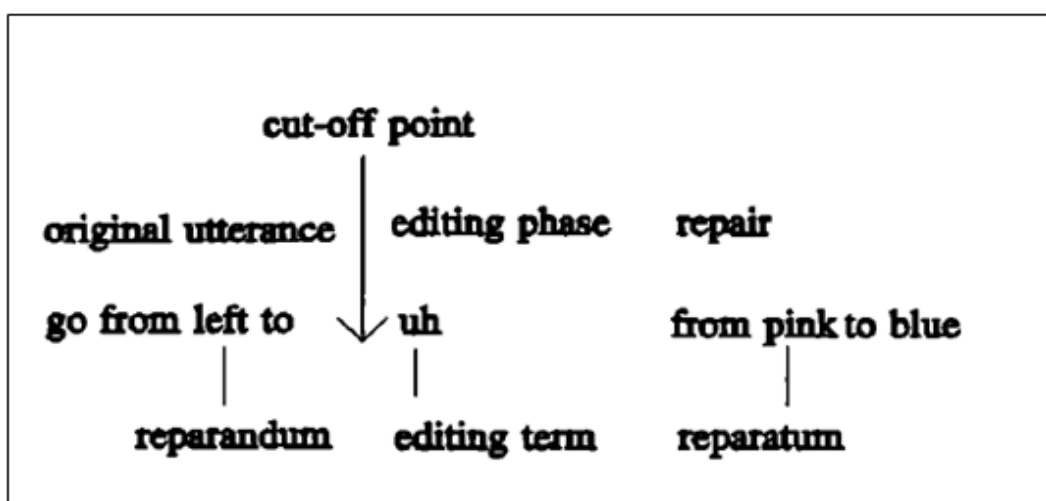


Figure 1: Structure of L1 Repair (Levelt, 1983)

Timing of these stages, i.e. duration in milliseconds of different phases of repair, have provided important information about the way L1 self-monitoring may operate in different contexts. PLT predicted that self-monitoring is dependent on central processing resources (i.e. working memory resources) where, in a situation when cognitive resources are limited, the duration of repair temporal features would be prolonged (Levelt, 1989). It was also hypothesised that monitoring is sensitive to different contextual factors which could result in directing more scrutiny to a certain aspect of an utterance (Levelt, 1989). L1 research employed various methods to validate such assumptions. The notion that L1 monitoring draws upon central processing resources was supported as L1 research indicated that cognitively demanding tasks had potential impact on repair types and temporal features of repair (Oomen & Postma, 2001; 2002). In short, L1 research has made notable progress in extending our knowledge about L1 self-monitoring mechanisms and functions.

With regard to L2 speech processing, it has been assumed that PLT can be applied to L2 self-monitoring with only minor changes (Kormos, 1999; 2000a; 2006). In Kormos's (2006) L2 speech production model, it has been argued that L2 speech processes largely draw upon central processing resources and therefore only few resources are available for monitoring during L2 speech production. Recently, L2 research have investigated the extent to which task complexity can influence the L2 self-repair process. For example, research attempted to explore the impact of task structure (i.e. a task with a clear storyline structure versus unstructured task) on different types of repair (Ahmadian, Abdolrezapour, & Ketabi, 2012). Findings showed that the structured task directed learners' attention towards error-repairs, whereas the unstructured task led participants to focus on appropriate-repairs (Ahmadian et al., 2012). These findings suggest that structured tasks may support the Conceptualiser, and thus more attentional resources were directed to the Formulator where more error-repairs ensued (Ahmadian et al., 2012). Impact of time pressure on different types of L2 self-repairs was also examined by Ahmadian & Tavakoli (2012) who studied the effect of providing abundant time for planning while talking versus no planning time on frequency of L2 self-repairs. It was found that having ample time while speaking led to more error-repairs and fewer appropriateness-repairs (Ahmadian & Tavakoli, 2012). These studies indicate that examining repair types in varying degrees of cognitively demanding conditions can be useful in studying the underlying mechanisms of L2 speech processing and revealing the extent to which these processes might be different from L1 speech processes.

Although repair types were examined in a number of L2 studies, little attention was paid to examining temporal characteristics of L2 repairs. One of the earliest studies that investigated the differences between L1 and L2 timing of repair was conducted by van Hest (1996). She found that certain temporal features of repair were longer in L2 utterances rather than L1 speech (van Hest, 1996). This was interpreted as a lack of automatization in L2 speech processing. In examining temporal phases of repair produced by L2 learners at different proficiency levels, it has been revealed that timing of repairs was influenced by participants' levels of proficiency (Kormos, 2000b). As an illustration, advanced learners planned their repairs in shorter intervals than intermediate learners. Moreover, a cognitively demanding task condition, such as performing concurrent tasks, has been employed to explore the effect of cognitive resources limitations on L2 monitoring (Declerck & Kormos, 2012). It has been found that increased cognitive demand has a negative effect on the efficiency of monitoring processes (Declerck & Kormos, 2012). As one limitation of their study was employing simple network description, it was recommended that future studies need to implement more complex speaking tasks along with dual task paradigm (Declerck & Kormos, 2012). In short, it might be illuminating to explore the extent to which L2 self-monitoring mechanisms can be affected when cognitive resources are consumed.

To conclude, investigating repair types and the temporal characteristics of repairs under varying degrees of cognitive demand seems useful and practical in exploring foci and mechanisms of L2 self-monitoring.

3. The Present Study

3.1 Definition of Self-Repair

L2 self-repair in this study is defined as revisions of one's own overt utterances for form or conceptual aspects, where a speaker may suspend the flow of speech upon perceiving an error or inappropriate aspect in his/her utterances, in order to plan and execute the repair. Some speakers may pause immediately prior to making an error or after making a repair. This definition indicates that overt repairs will include two types of repairs; Conceptual-Repair and Form-Repair. The potential phases of repair that will be investigated are also highlighted.

3.2 Repair Types

The aim of employing Form-repair and Conceptual-repair is to explore the influence of increased cognitive demand on two main speech stages (i.e. the Conceptualiser and the Formulator) and consequently on L2 self-repairs. Exploring these two categories may be crucial in investigating mechanisms of L2 monitoring (Kormos, 2006).

Conceptual-repair entails modifying a message for meaning, thoughts, propositions, or changing lexical items. In previous studies (see, for example, Declerck & Kormos, 2012), lexical elements were added to the Formulator's category (i.e. error-repairs). However, Zuniga (2015) argues that lexical repairs need to be added to the Conceptualiser's category. Zuniga's (2015) rationale for adding lexical repairs to the Conceptualiser's influences draws on Levelt's revised model (1999), where lexical items have been argued to entail conceptual preparation that is processed at the Conceptualiser (Levelt, Roelofs, & Meyer, 1999). This could be considered a challenge to the common notion that lexical processing is mainly dealt with at the Formulator (Kormos, 2000b, 2006). Following Zuniga's (2015) proposal, replacements (i.e. replacing a lexical item by another) can be added to the Conceptual-repair category in the present study. Form-repairs, on the other hand, entail revising syntactic, morphological or phonological elements. It may also include revising tense, preposition, determiner and inflection. To conclude, examining the two repair types, Conceptual-repair and Form-repair, is expected to shed light on the underlying processes of L2 self-monitoring.

3.3 Temporal Repair Phases

Temporal phases of repair entail the duration of different stages of L2 repairs. Rationale for including this category draws on the assumption that timing of repair phases can be helpful in making inferences about L2 self-monitoring mechanisms in different task conditions (Kormos, 2006).

This category includes the three main phases that were identified in L1 speech (Levelt, 1989): error-detection, interruption and repair (Section 2). Moreover, it includes two potential phases that may hypothetically be produced during L2 self-repair process; pre-error-detection pauses (i.e. pauses executed before detecting errors) and post-repair pauses (i.e. pauses produced after making repairs). Examining these two phases can be justified by the observation presented in comparative research which noted that unlike L1 speech, L2 utterances may include pauses before repetitions and replacements, and between errors and repair (Tavakoli,

2011). It has been assumed that these patterns of pausing and repair can reveal important information about monitoring behaviour in second language production (Tavakoli, 2011). Empirical support for this argument was further provided by Ahmadian, Abdolrezapour & Ketabi (2012). Data obtained from stimulated recall interviews shows that mid-clause pauses were used by L2 learners for monitoring their speech (Ahmadian et al., 2012); however, previous literature has not discussed potential patterns for pausing and repair in L2 utterances or whether patterns of repair and pauses could be affected when cognitive demand increases. Therefore, in the present study, a decision was taken that the investigation will include pauses that precede error detection and pauses that follow repair. Temporal repair phases have rarely been investigated in L2 research, and to the best of my knowledge only Declerck and Kormos (2012) examined the three main phases of repair under dual task condition. Yet, pre-error-detection pauses and post-repair pauses have never been made subjects of any investigation in previous research.

3.4 Aim of this Study

The purpose of this study is to examine the effects of cognitive demand manipulation with dual task condition upon the mechanisms of self-monitoring, particularly the repair types of Conceptual-repair and Form-repair, and temporal characteristics of monitoring, that is, the phases of making repair.

3.5 Research Questions

This study addresses the following research questions:

- 1) Are there differences between repair types when produced in single versus dual task conditions?
- 2) What are the effects of increasing cognitive demands (i.e. dual versus single task conditions) on the temporal phases of repair?

3.6 Hypotheses

A cognitively demanding task condition is expected to have impact on the production of repair types and temporal phases of repairs, therefore, it was hypothesised that:

Hypothesis 1: one type of repairs might be produced more considerably in the dual task condition compared to the single task condition due to the controlled nature of monitoring which draws on the availability of cognitive resources. Form-repair is expected to increase during cognitively demanding task (Gilabert, 2007).

Hypothesis 2: the duration of repair phases might be longer during the more demanding condition (i.e. dual task condition). This assumption draws on the PLT which predicted that in a situation when cognitive resources are limited, the duration of repair phases would be extended (Levelt, 1989).

4. Method

4.1 Participants

Twelve native speakers of Arabic participated in the study. They were L2 learners and university students in the English department. Their age ranged from 19 to 23 years. A C-test was administered to participants to assess their proficiency levels. Twelve participants were chosen as their score on the C-test was between 61 and 80 points out of 100. Aligning these scores with the Common European Framework of Reference (CEFR) (Council of Europe, 2001), their level of proficiency was at the B2, which was considered as an upper intermediate level of L2 competence.

4.2 Materials

The experimental materials consisted of two picture stories which the participants were required to describe in the two task conditions. One picture story presented a journey by a ship where a storm occurred and people were eventually rescued. The next picture showed a school day where fire started in a classroom and students were safely evacuated. These pictures were assumed to be similar in complexity and vocabulary they elicited. During the single task condition, participants were asked to narrate picture stories. On the other hand, the dual task condition, which was designed using E-prime Psychological Software version 3.0, involved narrating a picture story while performing a concurrent task. The secondary concurrent task was designed to show bubbles on a laptop screen while the picture story was being presented. Bubbles appeared continuously every 5 seconds and stayed only for 5 seconds. Each bubble consisted of a word naming either an animate or an inanimate object. Participants were instructed to press a certain button when they decided that the word described an animate object and other button should be pressed when a word described an inanimate object. Two keyboard buttons (i.e. Z and M) were marked with Arabic translations of words 'animate' and 'inanimate' ((حي) and (جماد) respectively) to make it easier for participants to do the task. The dual task condition consisted of four practice trials and 20 experimental trials. To reduce practice effects, picture stories were counterbalanced in the two task conditions. These two tasks (primary and secondary tasks) were designed specifically for the purpose of the present study and they were pre-piloted several times before using them in this study.

4.3 Procedure

The researcher met each student individually and explained the instructions of speaking tasks. The current study employed a between-subject design which entailed that half of the participants performed the single condition (six students), and the other half performed the dual task condition. One independent variable (task condition) with two levels (single and dual) was included in this study.

Twenty-four speech samples were transcribed. All speech samples were segmented into AS-units following Foster, Tonkyn & Wigglesworth (2000). Data was coded for measures of repairs and PRAAT software was used to measure pauses and temporal features of repair. Repair types were calculated in terms of the number of repairs per minute. The duration of repair phases was measured in milliseconds. Repair phases were also calculated per minute. To check interrater reliability, 10% of the data was coded by an expert rater and a high percentage of consistency (i.e. 92%) was obtained among raters. It was then assumed that a reasonable level of interrater reliability was achieved.

5. Results

Table 1 below displays the means and standard deviations of frequency of repair types and duration of repair phases calculated in milliseconds:

Dimension	Measures	Task Duality					
		Single		Dual		Sig. (two-tailed)	Effect size
		M	SD	M	SD	* <i>p</i>	<i>Cohen's d</i>
Repair Types	Frequency of Conceptual-Repair	0.01	0.01	0.02	0.02	.37	--
	Frequency of Form-Repair	0.008	0.01	0.02	0.02	.05	0.75
Repair Phases	Duration of Pre-Error-Detection-Pauses	.81	.33	1.83	.77	.23	--
	Duration of Error-Detection	1.60	.38	3.07	.65	.06	--
	Duration of Interruption	1.06	.32	2.35	.52	.04	2.98
	Duration of Repair	1.37	.28	3.14	.72	.03	3.27
	Duration of Post-Repair-Pauses	.40	.14	1.17	.25	.02	3.80

Table 1: Effects of Single and Dual Task Conditions on Repairs, **p* < 0.05

A series of independent-sample t-tests was administered to examine differences between repair measures in the two conditions. Findings indicate that there was no difference between Conceptual-repair in the two conditions. Form-repair, on the other hand, was produced more significantly in the dual task condition than the single condition.

Findings also reveal that there were statistically significant differences between the two conditions in some phases of repair, specifically duration of repair phases per millisecond. First, interval of pre-error-detection-pauses was almost the same in the two conditions. Also, error-detection interval shows no significant difference when produced in the single condition and the dual condition. Next, it appears that participants in the dual task condition spent more time planning their repair as interruption interval increased more significantly in the dual task than in the single task. A significantly longer interval was executed in the repair phase, when produced in the dual task than in the single task condition. Finally, more significant post-repair pauses were found in the dual task as compared to the single task conditions. These data suggest that the dual task condition appears to impose greater cognitive demand on L2 encoding processes which is further discussed in Section 6.

6. Discussion and Conclusion

The present study made an investigation into the effects of cognitive demands of dual task versus single task conditions on mechanisms of self-monitoring, that is, repair types and temporal characteristics of repair. Findings show that Form-repair significantly increased in the dual task condition compared to the single task condition. Also, certain longer intervals of repair phases were produced during dual task condition than single condition. These findings are discussed in Sections 6.1 and 6.2 in relation to PLT and L2 literature.

6.1 Repair Types

It was hypothesised that dual task condition might impose limitations on cognitive resources thus L2 learners might direct their resources to inspect a Form-repair during speech processing. The results indicated that participants made significantly more Form-repairs under dual task condition rather than single condition. On the other hand, there was no significant differences between Conceptual-repair in the two conditions. Figure 2 shows that both Conceptual-repair and Form-repair increased during dual task condition, yet only Form-repair reached significance in the dual task condition. This data suggest that L2 monitoring might become more intense during the dual task condition. Particularly sensitivity to form increased considerably in the dual task condition compared to the single condition. Means of repair types as well as standard error of means in the two conditions are presented in Figure 2, below.

It could be assumed that performing the dual task condition might impose considerable demand on the underlying speech processes particularly the Formulator, therefore more erroneous output (i.e. morphological, grammatical and phonological items) was produced during the dual task condition. The auditory loop, consequently, may intercept the Formulator errors in overt speech and correct them resulting in more Form-repairs in the dual task rather than single task condition. On the other hand, it should be noted that although the Conceptual-repair seems to increase in the same direction in the dual task, it does not show significant difference in the dual task condition compared to the single task condition. Therefore, the first hypothesis may be supported as significantly more Form-repair was produced in the dual task condition compared to the single task condition.

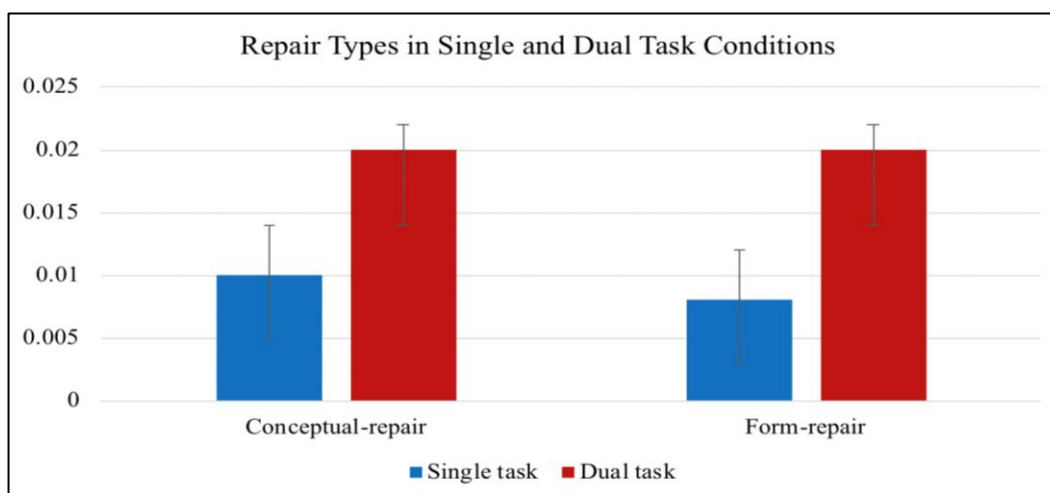


Figure 2: Repair Types in Single and Dual Conditions

Importantly, the increase in Form-repair during the dual task condition may suggest that the efficiency of L2 self-monitoring could likely increase to cope with the demanding dual task condition. Therefore, it appears that increased cognitive demand as operationalised in this study may not have a negative impact on monitoring process because L2 self-monitoring could adjust its functioning to cope with the demanding context. This might suggest that the sensitivity of L2 self-monitoring towards form may increase during the dual task condition. This finding may support Levelt's (1989) assumption that self-monitoring is sensitive to contextual factors. L2 research argued that when task demand increased, students noticed more errors and corrected a higher proportion of their errors (Gilabert, 2007). However, it has been suggested that certain task characteristics may draw attention towards form whereas other tasks may deviate attention

from focusing on form (see, for example, Robinson, 2011). To validate the assumption that the dual task condition may increase sensitivity to form, more studies are still needed.

6.2 Repair Temporal Phases

It was hypothesised that duration of repair phases might be prolonged when produced in the dual task condition. This hypothesis was partly supported as only some repair phases were significantly longer in the dual task condition compared to the single task condition. However, it should be noted that the duration of temporal phases of repairs numerically go in the same direction when produced in the dual task conditions compared to single task condition (see Figure 3, below, where means of repair phases in the two conditions are also reported).

First, duration of pre-error-detection-pause was predicted to be extended during the concurrent task. It was expected that this interval might be executed by L2 learners to monitor utterances that involve error or inappropriate items. Data show no significant difference between pre-error-detection-pause intervals in the two conditions. It could be assumed that this phase may hypothetically precede certain types of repair rather than others. In this study, temporal characteristics of overall repair were calculated and this did not provide detailed information of temporal features for different repair types. It could be assumed that pauses produced before Conceptual-repair and Form-repair might differ in various task conditions. Future research need to examine the temporal phases of each repair type distinctly as this could reveal important information about monitoring mechanisms.

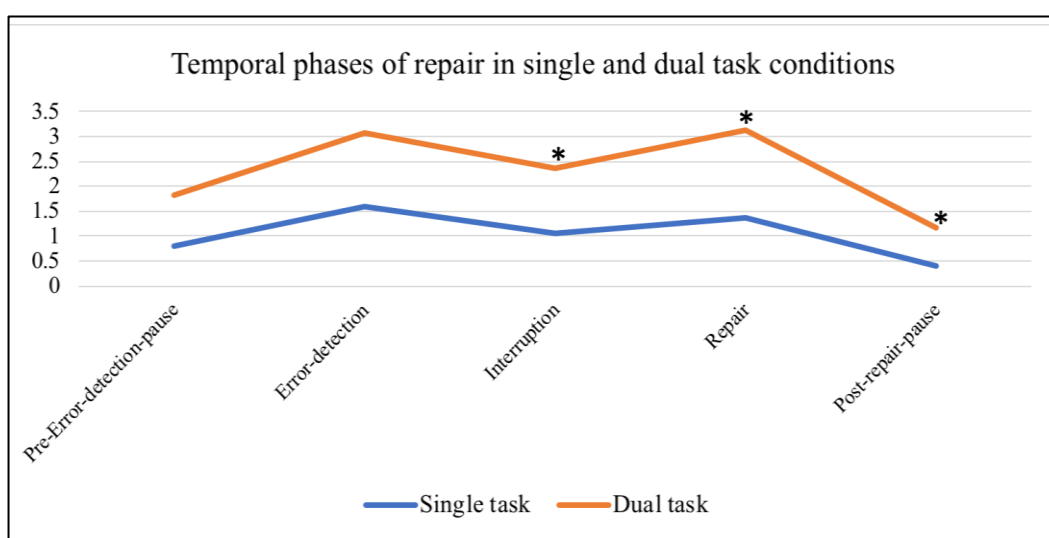


Figure 3. Repair Phases in Single and Dual Conditions, * $p < 0.05$

With regard to error-detection phase, it was found that there was no significant difference in the detection latency in the two conditions. Although it was expected that dual task condition might impose greater cognitive demand and create longer latency intervals, the reverse turned to be the case. The lack of significant differences between the two conditions in error-detection interval might indicate that because self-monitoring largely draws on the comprehension system, which is generally fast (Levelt, 1989), error-detection may not be greatly affected by cognitively demanding tasks.

Interruption time was expected to be longer during the dual task condition. As interruption time is hypothetically used to prepare the corrections to erroneous or inappropriate aspects of speech, this stage is characterised by producing filled and/or unfilled pauses before the repair is executed (Levelt, 1989). Data shows that interruption time was significantly longer in the dual task condition which suggests that L2 learners spent significantly longer interval to re-

plan their utterances when they performed concurrent tasks. In other words, when performing dual task condition, L2 speakers produced significantly more filled and/or unfilled pauses while they were preparing their repairs. It has been assumed that repair re-planning can be prepared in the Conceptualiser and the Formulator (Oomen & Postma, 2002). Thus, the longer interval of repair re-planning during dual task condition may indicate that cognitive demands of this task condition may impose limitation on the processing resources and could consequently slow down the encoding processes. Future research needs to examine how the interruption phase of different repair types can be affected under cognitively demanding conditions.

The fourth temporal phase of repair, repair execution, was expected to be considerably longer during the dual task condition. The findings show that participants needed significantly longer intervals to execute repairs in the dual task condition than the single task condition. This suggests that the dual task condition may potentially slow down the process of repair production. According to PLT, the process of repair execution is also inspected by monitoring (Levelt, 1983). In the case of increased cognitive demand, it could be assumed that the exhausted resources could potentially slow down the processes of monitoring and executing of repair.

Pausing after repair was predicted to be influenced by performing the concurrent tasks. Data show that this stage was significantly affected by the dual task condition. It could be postulated that due to the effortful process of self-repair, L2 speaker might need to recover before commencing a new utterance, therefore, a significant longer interval of pauses was produced; however, such an assumption needs to be further examined both quantitatively and qualitatively.

To conclude, manipulation of cognitive demand as operationalised in this study may likely consume available processing resources. The notion that self-monitoring adjusts its efficiency according to the demand of the situation (Oomen & Postma, 2001) might be supported as significantly more Form-repairs were intercepted in the more demanding task. Producing prolonged temporal phases of repair in the dual task condition may confirm the assumption that self-monitoring draws upon the available cognitive resources.

7. Conclusion

In this study, the effects of dual task demand on monitoring mechanisms were examined. The results indicate that the dual task condition as operationalised in this study may consume available cognitive resources. Despite interference from a secondary task, self-monitoring sensitivity to form increased significantly. This data may have implications for the second language speech production models and L2 self-monitoring behaviour. However, the pilot study has limitations because it was conducted with a small number of participants and thus more research with a larger number of participants is needed. Future research should consider implementing retrospective interviews to highlight certain areas of repair process such as why L2 speakers pause before error-detection or after repair, and why it takes a longer time to plan repair in the dual task condition. It would also be interesting to investigate how the dual task condition can affect self-repairs on tasks with different degrees of complexity, as this may reveal a wider picture of L2 self-repair and self-monitoring behaviour.

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