The response-cued completion hypothesis and the nature of residual cost in regular switch

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ABSTRACT

Three experiments are presented that compare the residual cost found when shifting from one task to another under different extra-response conditions, to test whether the response is the main factor to complete mental set reconfiguration. We investigated whether residual costs can be eliminated if participants carry out a response prior to completing switch trials. In all experiments, participants were required to press an extra key during the inter-trial interval (ITI) to proceed. In experiment 1, this extra response consisted of pressing the space bar. In experiment 2, the response consisted of pressing one of two possible keys that belonged to the alternating tasks response set. In experiment 3, the interpolated response involved pressing one of two possible keys, not belonging to the response set of the alternating tasks. We found no residual cost in the second or the third experiments. To explain the nature of residual cost we discuss the data in the context of a response cued completion hypothesis.

1. Introduction

When people have to switch from an ongoing activity to a new one, a transient impairment in performance may be observed, which can be measured both as a decrease in accuracy or as an increase in reaction time (RT). If we want to study this impairment in laboratory, we can ask participants to alternate between two simple cognitive tasks. When participants' performance is measured in this condition, a switch cost (increased reaction time or decreased accuracy) is found with respect to pure baseline conditions, in which the participant carries out a single task throughout the experimental session. Task switching effects are related to a general issue of psychology, in that they act as an index of the influence of a previous mental state on a subsequent one.

1.1. The Switching Paradigm

Allport, Styles and Hsieh (1994) employed the switching paradigm. Since this publication, the topic has recovered importance, and a number of studies have been published. Rogers and Monsell (1995) carried out a series of experiments to explore the preparation for a new task. They made sure that no differences in either stimuli or responses existed between the tasks. A stimulus pair consisting of a number and a letter was presented on every trial, and participants were asked to respond either to the letter or to the number. Both tasks shared the same set of responses. The two tasks alternated every two trials (except in their last experiment, which will be explained later), so that the experiment consisted of repetitions of four-trial sequences: letter-letter-number-number (LLNN). On each trial within a given sequence, the stimuli were presented in different screen quadrants. This allowed participants to keep track of the task required on a given trial. Rogers and Monsell's (1995) results showed a reliable decrease in switch cost as preparation time increased. However, the costs never vanished, even when very long fore periods were used.

1.2. Two Components in Switch Costs

Based in these previous results, Rogers and Monsell concluded that there are two different components in switch cost. They called one of them *non-residual component* and the other *residual component*. The former could be eliminated by an active (endogenous) process of preparation, while the other could not. People can adopt a task-set reconfiguration endogenously in advance of the fore coming stimulus, but this endogenously driven task-set's adoption is not sufficient to complete the reconfiguration.

1.3. The Study of Residual Component of Switch Cost: a real cognitive limitation

In their experiment 6, Rogers and Monsell (1995) explored the nature of the residual component of cost. In this case, tasks alternated every four, instead of every two trials, which produced eight-trial sequences (LLLLNNNN). Stimuli were presented in different sectors of a circle divided into eight parts. They found cost after a 1200-ms RSI with predictable switch, and this residual cost dissipated after the first repetition trial, so that no further improvement occurred on subsequent repetitions. Subsequent studies have also found evidence of a switch-cost component that does not disappear as preparation time increases (i.e. Dreisbach, Haider, Kawski, Kluwe & Luna, 1998; Gopher, Armony & Greenshpan, 1998; Sohn & Anderson, 2001). The abrupt disappearance of residual cost in first repetition trials has been replicated a number of times as well (e.g. Allport et al., 1994; Rogers & Monsell, 1995, experiment 6; Meiran, 1996; Milán & Tornay, 1998; Pösse & Hommel, 1998; Tornay & Milán, 2001, experiment 3).

1.4. The Role of the Stimulus in Mental Set Reconfiguration.

Usually, it is assumed that the appearance of a task-related stimulus is the key feature for cost to vanish. Rogers and Monsell, for example, maintain that the residual component of cost depends on a new experience with a stimulus related to the new task. The appearance of the target would trigger a so-called exogenous reconfiguration process--the *stimulus-cued-completion hypothesis*. A similar position about the stimulus importance has been adopted by Pösse and Hommel (1998) and Stablum, Leonardi, Mazzoldi, Umiltá, and Morra (1994). However, until now, researchers have not been able to isolate stimulus factors from response factors. It is clear that residual cost disappears on first repetition trials with regular sequences (Tornay & Milán, 2001), but it is impossible to determine whether or not this depends on the experience with the stimulus (Stimulus-Cued-Completion Hypothesis) or if it is related to the response (Response-Cued-Completion Hypothesis). Perhaps the execution of a response that is relevant for the task at hand is the necessary condition to complete the process of reconfiguration. In this research, our main goal is to manipulate response factors to test whether the mental set reconfiguration can be completed under these conditions.

1.5. Hypotheses and Overview of the Experiments

Our hypothesis (the response cued completion hypothesis) predicts that residual switch costs disappear as soon as a response related to the new task is executed. To test that, we introduced an intermediate response (the *extra* response) between the alternating tasks (T1 and T2), which consisted in pressing a key on the keyboard to continue with a new trial. Importantly, this extra response was carried out during the inter-trial interval (ITI) and, hence, before the target stimulus onset. This condition was compared with a regular switch condition (a replication of Tornay & Milán, 2001, experiment 3) without any extra response.

The hypothesis based on the experience with the stimulus (Rogers and Monsell's stimulus cued completion hypothesis) would predict no differences between these conditions. In addition, it would predict residual cost in all of our new conditions. Our hypothesis predicts the disappearance of cost when participants execute a related intermediate response under regular switch conditions. Taking into account that task switching is predictable in these experiments, the ITI can be considered a part of the anticipatory period. Therefore, we predict that the execution of a related response during the ITI, triggers the process to complete reconfiguration. On the other hand, when the intermediate response is unrelated to the task (i.e. it does not belong to the response task set), or transpires outside the foreknowledge period of switch intention, we expect residual cost to appear.

In short, our study is in pursuit of a number of goals: first, we aim to replicate previous research and demonstrate that in a predictable switch, and with long RSI, we can find residual cost, which disappears in first repetition trials. Secondly, we aspire to identify whether or not residual cost is associated with response factors. If this is the case, then the presence of residual cost should be eliminated when subjects' carry out a response before the switch trials.

2. Experiment 1

We have designed a condition whereby we are able to test the role played by the response in mental set reconfiguration processes, in the absence of the target stimulus**.** In this experiment, we aim to investigate whether or not a motor response, irrelevant to the alternating tasks, is sufficient to complete the reconfiguration under predictable switch conditions. The interpolated task requires the participant to press the space bar to proceed but this motor response is not directly related to the target stimuli. Is it possible that any response between task 1 and task 2 could eliminate residual cost? If carrying out an unrelated response is the key to completing the reconfiguration, residual switch cost should be absent in shift trials

2.1. Method

2.1.1. Participants

Twelve undergraduate students (ten women, and two men) with normal vision participated.

2.1.2 Design

We used a repeated measures design with four independent variables. Three of them varied on a trial-by-trial basis: congruency (congruent or incongruent responses, explained later), task (number task or letter task), and repetition (switch trials, first repetition trials and second repetition trials). The fourth variable was named "extra response" (extra response vs. no extra-response during each ITI), manipulated in blocks. The RSI (Response-Stimulus-Interval) was 1,200 milliseconds (ms) throughout the experiment. The predictability was always the same, in that the task switching occurred every three trials: LLLNNN (with "L" being the letter task and "N" being the number task).

2.1.3. Apparatus and Stimuli

The experiments were designed using the e-prime software program (Schneider, Eschman & Zuccolotto, 2002). They were run in dimly illuminated rooms, on Intel Pentium computers with VGA graphics card. A chin-rest was used in the experiment to help participants maintain their vision at a distance of 60cm from the computer monitor.

On every trial a fixation point appeared at the center of the computer screen. This fixation point was either "#" or "@" symbol, depending on which task was being performed (see below for explanation). Both symbols were suspended at a visual angle of 2.86° x 2.86. Subsequently, a stimulus pair, consisting of a number and a letter (e.g., 6K, E9, 3P, S4...) was presented at the center of the screen, replacing the fixation point. The stimulus pair remained on the screen for 500 ms, it covered a visual angle of 4.76° X 4.76°.

In the extra response condition, a message appeared on the screen in between the response in a given trial and the fixation point announcing the next, asking participants to "press the space bar". The next trial did not begin until this response was executed.

2.1.4. Procedure

Our participants were asked to carry out one of two possible tasks in each trial. They had either to indicate whether the number of a pair (number-letter, i.e. A7) was odd or even (number task) or whether the letter was a vowel or a consonant (letter task). In both tasks, participants responded by pressing the "b" or the "n" key on the keyboard. This way, both tasks shared the same stimuli and the same responses. Half the participants were required to press the "b" key to indicate that the number was even or the letter was a vowel and "n" when the number was odd or the letter was a consonant. For the other half, the reverse stimulus-key mapping was used. Each participant was randomly assigned to either mapping. On 50% of the trials both stimuli required the same responses (i.e., they were congruent trials); with the remaining 50% of the trials non-congruent. Participants were given a maximum of three seconds after the appearance of the stimulus pair to emit the response before proceeding to the next trial. The new fixation point was presented as soon as the trial finished (i.e. the response was emitted or the 3 s elapsed). Therefore, the RSI (Response-stimulus interval) corresponded with the cue (fixation point) stimulus (target) asynchrony (1200 ms).

Participants knew which task was to be carried out on a given trial by means of the fixation point presented: a "#" signaled the number task; with the "@" indicating that the letter task was required on that trial. Tasks alternated regularly every 3 trials: LLL-NNN ("L" being the letter task and "N" being the number task). Therefore, there were three kinds of trials in both tasks: the first one in a series of three trials would be called the switch trial; the second one would be called the first repetition trial; and the third would be called the second repetition trial.

There was an experimental session with a total of 1200 trials, 240 practice trials and 960 experimental trials, with 480 experimental trials for each extra response condition (2x480). These 480 trials in each condition were divided into two blocks of 240 trials. Before each block, participants ran 60 practice trials, in which they practiced both tasks (letter task and number task); short breaks were permitted between blocks.

During the experimental session all possible combinations of stimuli (even-vowel, e.g., 4A;

even-consonant, e.g., 4B; odd-vowel, e.g., 5A; odd-consonant, e.g. 5B; in the two possible orderings, number-letter or letter-number) were presented. All combinations of trial-independent variables (congruency, task and repetition) occurred with the same frequency across the whole experiment. Participants were instructed to avoid errors while trying to respond as quickly as possible.

2.2 Results

We entered both RT and accuracy data into a *2 (extra response) x 3 (repetition) x 2 (task) x 2 (congruency)* repeated measures analysis of variance (ANOVA). In all cases, a α level of .05 was adopted as a significance criterion.

RT measures (see figure 1) resulted in a significant main effect of task, F (1, 11) = 9.46, and repetition, F (2, 22) = 10.87. There was a reliable interaction involving the variables extra response, task, and repetition, F (2, 22) = 5.08, with an observed task asymmetry in extra response condition. There was an effect of repetition only in the number task, F (2, 22) = 6.74. There was a reliable effect of repetition in No extra response condition for both letter task, F (2, 22) = 10.28, and number task, F (2, 22) = 12.91.

Please insert figure 1 about here

In the no extra response condition, we observed a reliable effect of task, F (1, 11) = 11.18, (slower reaction time in the letter task) and repetition, F (2, 22) = 15.64. There were differences observed between the switch trials and first repetition trials, F (1, 11) = 17.89, and between the switch trials and second repetition trials, F (1, 11) = 17.77; with no differences between the first and the second repetition trials, F (1, 11) < 1.

The same results are observed in the extra response condition: there were a reliable effect of the task, F (1, 11) = 5.23 (faster reaction time in the number task), and repetition, F (2, 22) = 4.73, and reliable interactions involving congruency and task, F (1, 11) = 5.42, and task and repetition, F (2, 22) = 3.74 (lower cost in the letter task). There were differences between switch trials and first repetition trials, F (1, 11) = 5.08, and also between switch trials and second repetition trials, F (1, 11) = 4.65 (p= 0.053). No differences could be observed between first repetition trials and second repetition trials, F (1, 11) < 1.

The accuracy data (see table 1) showed a main effect of the task, F (1, 11) = 16.95 (accuracy was betterin the letter task), and repetition, F (2, 22) = 8.36. We observed a reliable interaction involving congruency, task and repetition, F (2, 22) = 6.15 (in the number task, task-switching costs were reliable in congruent but not in incongruent trials, whereas the opposite effect was observed in the letter task).

Please insert table 1 about here

2.3. Discussion

Here we replicated the results from Rogers and Monsell (1995) and those of Tornay and Milán (2001), demonstrating a residual cost that appeared under predictable conditions and long preparation periods. These results have been taken to provide evidence that cost offset is abrupt, resulting in no differences between first repetition trials and second repetition trials. The fact that switching costs were not systematically affected by the extra response rules out the possibility that the execution of any response during the mental set switching period is sufficient to make residual cost disappear. Accordingly, we conclude that task-unrelated, simple response do not trigger the mechanism of mental set reconfiguration in switching from an ongoing task to a new one. In experiment 2 we aimed to go further in exploring the nature of the response necessary to complete the reconfiguration.

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3. Experiment 2

What would happen if the response to be executed during the ITI to proceed belongs to the response set? In the second experiment the message on the screen required participants to press the “b” key, or to press the “n” key, in order to initiate a new trial. In this case, during the ITI, the response required belonged to the response set of the alternating tasks, even though this intermediate response (b or n) did not predict the correct answer in the next trial. If the execution of a task-associated response completes the reconfiguration in the absence of the target stimulus, then we expect residual costs to be absent in the extra response condition.

3.1. Method

3.1.1. Participants

Twelve undergraduate students (nine women, and three men) with normal vision participated.

None of them took part in experiment 1.

3.1.2. Design, Apparatus and stimuli

The design was identical to that employed in the first experiment, except for one aspect: the message that appeared in the extra response condition required participants to press the “b” key or the “n” key randomly, with a probability of 50%. This response did not predict the correct answer in the next trial. If the message during the ITI was to press the “b” key, then the correct answer in the next trial was “b” in 50% of cases, and “n” in the other 50% of cases. The same probabilities applied if the message was to press the “n” key.

3.1.3. Procedure

The procedure was identical to that in experiment 1. There were 1200 trials, 960 experimental trials and 240 practice trials. As in experiment 1, the participants carried out the no extra response condition first, and the extra response condition second.

3.2. Results

We analyzed the data as in experiment 1.

RTs (see figure 2) showed a reliable main effect in repetition, $F\ (2,\ 22) = 5.12$. There was a reliable interaction involving extra response and repetition, $F\ (2,\ 22) = 4.47$, due to the decreased reaction times in the switch trials in the extra response condition. The differences between both conditions (extra response and no extra response) were reliable in the switch trials, $F\ (1,\ 11) = 4.87$, but not in the repetition trials.

Please insert figure 2 about here

When we analyzed the no extra response condition data, there was a reliable effect in repetition, *F*

(2, 22) = 6.25. There were no reliable effects of task or congruency, nor any reliable interaction. In this condition we observed reliable differences between switch trials and first repetition trials, F (1, 11) = 5.69, as well as differences between switch trials and second repetition trials, F (1, 11) = 9.04; with no differences observed between first repetition trials and second repetition trials, F (1, 11) < 1.

The analysis of the extra response condition showed no reliable effect of repetition, congruency or task, p>0.05. In this case there were no reliable differences between switch trials and first repetition trials, between switch trials and second repetition trials, or between first repetition trials and second repetition trials, p>0.1.

Accuracy data showed a main effect of repetition, F (2, 22) = 9.40, and task, F (1, 11) = 7.56. We observed reliable interactions involving extra response and repetition, F (2, 22) = 4.18, and extra response, task and repetition, F (2, 22) = 8.08 (see table 2). In the accuracy data in each condition, we observed effects in the no extra response condition in repetition, F (2, 22) = 15.24, and a reliable interaction involving task and repetition, F (2, 22) = 5.62. In the number task we observed a reliable effect of repetition, F (2, 22) = 19.51, an effect not found in the letter task, (p>0.05). In the extra response condition there was no reliable main effect and no reliable interaction.

Please insert table 2 about here

3.3. Discussion

In this second experiment, we again replicated the abrupt disappearance of residual cost in first repetition trials. In the extra response condition, the main difference with respect to experiment 1 was the nature of the response to execute during the ITI. In this case, the response belonged to the task set, but it did not (1) make any semantic reference to the switching tasks; (2) predict the task to execute in the following trial; or (3) predict the correct answer in the following trial. Nevertheless, we observed that it facilitates switching to a new task. If we compare our baseline condition (blank ITI or no extra response condition) with the interpolated task condition or the extra response condition, then the RT differences show a facilitation of task switches.

4. Experiment 3

There were two main differences between the designs of experiment 1 and experiment 2: in experiment 1 the extra task was a single task and the interpolated response was unrelated to alternating tasks. In experiment 2, the extra task was a choice task and the interpolated responses were related to alternating tasks. Until now we have interpreted the results with respect to the nature of the interpolated response (related or unrelated to response set), but there is an alternative explanation: the key factor may not be task relevance but the number of response alternatives in the extra-task (simple or choice task). To test this alternative hypothesis we conducted a third experiment with an extra choice task in which the response alternatives were not taken from the response set of the alternating tasks. The response cued completion hypothesis predicts significant residual cost in the extra response condition, whereas the alternative-based hypothesis would predict that these costs are eliminated by the extra response, just like in experiment 2.

4.1. Method

4.1.1. Participants

Twelve undergraduates students (ten women, and two men) with normal vision participated. None of the subjects had participated in experiments 1 or 2.

4.1.2. Design, Apparatus and Stimuli

The design was identical to that employed in experiment 2 except for one aspect: the message that appeared during the ITI asked participants to press the “R” key or the “O” key with the index finger, with a probability of 50%. Specifically, to start a new trial, participants were asked to press the red key (corresponding to the R key, covered by a red sticker) or the black key (corresponding to the O key, covered by a black sticker).

4.1.3. Procedure

The procedure was identical to that in experiment 1. There were 1200 trials, 960 experimental trials, and 240 practice trials. As with experiment 1, the participants carried out the no extra response condition first, and the extra response condition second.

4.2. Results

We analyzed the data as in experiment 1. RT measures (see figure 3) showed a reliable effect of repetition, F (2, 22) = 4.62. There were no significant effects of extra response, congruency and task ($p > .05$). However there was a reliable interaction involving extra response and repetition, F (2, 22) = 11.57. The difference between shift trials in the extra response condition and shift trials in the no extra response condition was significant, F (1, 11) = 20.03.

Please insert figure 3 about here

When the no extra response condition data were analyzed, we observed a reliable effect in repetition, F (2, 22) = 17.27. There were no reliable effects of task or congruency, nor any reliable interaction between the two. In this condition we observed reliable differences between switch trials and first repetition trials, F (1, 11) = 13.66; and also between switch trials and second repetition trials, F (1, 11) = 22.84; but no differences between first repetition trials and second repetition trials were observed, F (1, 11) < 1. The analysis of the extra response condition showed no reliable effect of repetition, congruency or task.

Accuracy data (see table 3) showed a main effect of repetition, F (2, 22) = 8.12. We observed reliable differences between switch trials and first repetition trials, F (1, 11) = 6.28; and also between switch trials and second repetition trials, F (1, 11) = 19.4.

Please insert table 3 about here

4.3. Discussion

Contrary to our expectations, carrying out an extra response that is unrelated to the response set of the alternating tasks was as successful in eliminating task-switch costs as the set-related extra response used in experiment 2. Accordingly, we assume that the key factor for reconfiguration is not a task-related response but a choice task as such.

5. General Discussion

Our original hypothesis predicted the disappearance of residual task-switching costs when participants execute a task-related intermediate response under otherwise regular switch conditions. Taking into account that task switching was predictable in our experiments, the ITI can be considered as an interval that allows for the preparation of a task switch. Accordingly, we expected that the execution of the extra-response during the ITI in experiment 2 would trigger the process necessary to complete the reconfiguration. In contrast, if the intermediate response would not belong to the alternating tasks response set we would expect residual cost to appear. However, whereas any interpolate choice task eliminated residual cost (experiments 2 and 3) a non-choice task did not (experiment 1). It is thus possible that only tasks that require different S-R decision rules than the alternating tasks can eliminate switching costs.

There is a possible confound that might challenge our main conclusion with regard to experiments 2 and 3: One may argue that in these experiments, participants had to alternate between three tasks: the choice reaction time extra-task (E) and the alternating letter and number tasks. Instead of LLLNNN sequences, there were thus LELELENENENE sequences. This would imply that we can consider all trials shift trials in the extra-response condition. If this were true, then our results should show a similar RT for the extra-response condition trials and the shift trials in the no extra-response condition. But we found a significant difference between these two conditions. However, the extra response condition was administered after the baseline condition, at a more practiced stage. Since greater practice may be associated with shorter RT, the trials in the extra response in ITI condition perhaps behaved like switch trials. Again, we think this confound is not particularly relevant because there were no practice effects in experiment 1 (mean RT was similar in the baseline and the extra response condition); RT for repetition trials in the extra response condition of experiment 1, and RT for switch trials of the same condition of experiments 2 and 3 were also similar, even though all these trials were administered second.

Some added clarification maybe achieved by considering response sequence effects between trials n-1 and n, because task switches tend to be associated with response repetition cost, whereas response repetition positive priming is obtained on task repetition trials (Rogers & Monsell, 1995). Our results showed the same interaction between response repetition and task repetition in all experiments and conditions: In the extra response condition of experiment 1 we found in task shift trials, a significant response repetition cost of 66 ms (mean RT in response repetition trials of 813 ms and in response shift trials of 747 ms, F (1, 11) = 6.2) and in task repetition trials a significant response repetition benefit of 27 ms (mean RT in response repetition trials of 726 ms and in response shift trials of 753 ms, F (1,11) = 5.2). In the same condition of experiment 3, the results showed a significant response repetition benefit of 34 ms in task repetition trials (mean RT in response repetition trials of 772 and in response shift trials of 806 ms, F (1, 11) = 5.4), but there was not repetition cost or benefit in switch trials. It was exactly the same pattern obtained in the baseline condition in experiments 1 and 3 (a significant response repetition benefit in task repetition trials of 44 ms and 29 ms respectively but a non significant response repetition effect in task shift trials). What seems clear is that inserting a choice task into each ITI does not convert all trials into task switches. This implies that we can rule out this objection.

One last argument against the role of the response regarding residual cost elimination may be that there was no control condition involving a choice task without a response. However, Milán et al. (2005; submitted) ran this control condition with the go-no go methodology introduced by Schuch and Koch (2003), but with a delay of 500 ms between target onset and the go signal. We found residual cost in first repetition trials after no-go shift trials. These results are consistent with the idea that it was the extra (choice) response that caused the elimination of switch cost in our experiments 2 and 3.

With respect to the current discussion about the relationship between endogenous and exogenous components of switch cost (Rubinstein, Meyer, & Evans, 2001; Ruthruff et al., 2001; Sohn & Anderson, 2001), we believe that they are not completely independent. According to Rogers and Monsell (1995) the endogenous component represents the activation of the intention to switch the task. This intention cannot be completed before the stimulus onset. In fact, our data show that the response execution in the choice task is more important. Alluding to Rogers and Monsell's Stimulus-Cued Completion hypothesis, task repetition is dependent on task preparation. Rogers and Monsell concluded that- "although task-set reconfiguration can be initiated endogenously, the exogenous trigger of a stimulus attribute associated with a task is needed to complete the process of reconfiguring to perform that task". So, reconfiguration can start endogenously, but exogenous factors associated with the stimulus are the key to completing this process. Our results are inconsistent with the stimulus cued completion hypothesis (i.e. reconfiguration happens in the absence of the target stimuli) and in favor of the task cued completion hypothesis when switching from an ongoing task to a new one (i.e. activation of S-R decision rules and response execution).

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Figure 1.

Figure 2.

Figure 3

	<u>Switch</u>	<u>First repetition</u>	<u>Second repetition</u>
No Response in ITI	6%	3%	4%
Response in ITI	7%	5%	5%

<u>TABLE 1.-</u> Accuracy data in experiment one. Represents the percentage of errors in both Conditions in experiment one.

	Letter	Letter	Letter	Number	Number	Number
	Switch	1st Repe	2nd Repe	Switch	1st Repe	2nd Repe
No Response in ITI	9%	8%	7%	15%	9%	9%
Response in ITI	10%	9%	7%	9%	10%	9%

TABLE 2.- Accuracy data in experiment 2. Represents the percentage of errors in the interaction involving Condition, Task and Repetition in experiment 2.

	Switch	First repetition	Second repetition
No Response in ITI	10%	8%	7%
Response in ITI	11%	9%	7%

TABLE 3.- Accuracy data in experiment 3. Represents the percentage of errors in both Conditions in experiment 3.

Figure caption

FIGURE 1.- Mean reaction times for both conditions in experiment one. The triangles represent the results in Response in ITI Condition. The squares represent the results in No Response in ITI Condition In the abscise exe, the number of consecutive repetitions of the same task is represented.

FIGURE 2.- Mean reaction times for both conditions in experiment 2. The triangles represent the results in Response in ITI Condition. The squares represent the results in No Response in ITI Condition. In the abscise exe, the number of consecutive repetitions of the same task is represented

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FIGURE 3.- Mean reaction times for both conditions in experiment 3. The triangles represent the results in Response in ITI Condition. The squares represent the results in No Response in ITI Condition. In the abscise exe, the number of consecutive repetitions of the same task is represented

AUTHOR NOTE

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