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Attentional Blink: The Effect of Lag on T2 Detection

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Abstract

Attention refers to focusing on a single thing and ignoring competing distractions in the environment. Attentional blink refers to the failure to detect a second stimulus while focused on something else. In this study, attentional blink was tested using the rapid serial visual presentation (RSVP) task. T1 was defined as the red letter, and T2 as the letter X. Short lag and long lag were used as independent variables to examine T2 detection. As a result, lower T2 detection was observed with short lags, and higher T2 detection was observed with long lags. The hypothesis was supported, and attentional blink was replicated. These findings are consistent with previous research and further support the idea that attention has limited processing capacity.

Keywords: *Attention, Attentional Blink, RSVP, T1/T2 stimuli, Lag, Stimulus detection, Limited processing capacity, Cognitive psychology*

1.Introduction

Attention refers to the ability to focus on a specific goal while removing competing distractions. This also indicates that the attentional system suppresses irrelevant information from the environment (Thakral & Slotnick, 2010). Paying attention to a stimulus facilitates learning and memory related to that information while ignoring background noise. Attention can be explained by Broadbent's early selection theory (1958), which proposes that attention operates as a filter. After information enters the sensory register, it is selectively filtered. This filtering process prevents the limited capacity system from becoming overloaded.

On the other hand, sometimes when humans are focused on something, they fail to notice other salient and distinctive stimuli. This is known as the attentional blink. According to Jensen et al. (2011), attentional blink is known as the 'failure of visual awareness'. Attentional blink is usually observed in rapid serial visual presentation (RSVP) tasks, where letters or numbers are presented quickly one after another and participants are required to detect target stimuli. Since attention is a limited process, humans may fail to notice other significant events (Jensen et al., 2011). A salient object may not always attract attention (Simons, 2000). This demonstrates that attention is selective and limited, which helps explain attentional blink.

Attentional blink can be explained by the two-stage processing theory. This theory explains that the brain processes information in two stages (Stage 1 and Stage 2). It states that in Stage 1, the brain perceives information quickly and superficially, while in Stage 2, information is processed more slowly

and transferred to working memory. Attentional blink occurs when the brain fails to notice the second stimulus (T2) because attentional resources are occupied by the first stimulus (T1). For example, Ward (2020, pp. 217–219) explains that when attentional resources are used to process the first target (T1), processing the second target (T2) becomes more difficult.

However, studies have found that even when the stimulus is not consciously perceived, it is partially processed by the attention system (Bressan & Pizzighello, 2008). Attentional blink generally occurs within a short time interval. If the second target (T2) occurs shortly after the first target (T1), attentional blink may occur.

Therefore, the present study investigates how the time interval between T1 and T2 affects the likelihood of attentional blink. The hypothesis of this experiment is that accuracy of T2 detection will decrease in short lags. This study aims to replicate the attentional blink effect first demonstrated by Raymond et al. (1992). Supporting this idea, Thakral & Slotnick (2010) found that unexpected stimuli are less noticeable in areas close to the focus of attention.

Methods

Letters were presented in a rapid serial visual presentation (RSVP). On each trial, 21 random letters were presented at a rate of 10 Hz. In the stream, the 7th letter was always presented in red and served as T1. In half of the trials, the letter X appeared as T2. The stimulus material consisted of the red letter (T1) and the letter X (T2).

Participants were undergraduate students, and each participant completed 20 trials. A total of 562 participants took part in the study. The experiment consisted of two tasks: a dual detection task and a single detection task. In the dual detection task, participants were asked two questions: which letter was presented in red and whether they saw the letter X. Both T1 and T2 detection were analysed in the dual task. In the single detection task, participants were asked to ignore the red letter and report whether an X appeared. The main measure of interest was the accuracy of detecting T2. T1 responses were also recorded in the dual detection task. There were 20 trials per task, resulting in 40 trials in total.

In half of the trials, T2 occurred 300 ms after T1, and in the other half, T2 occurred 700 ms after T1. The time interval between T1 and T2 served as the independent variable. The dependent variable was whether participants detected T2 at short or long lags. The experiment was conducted on a computer, and instructions were presented before the task began. A practice trial was conducted before the experiment began.

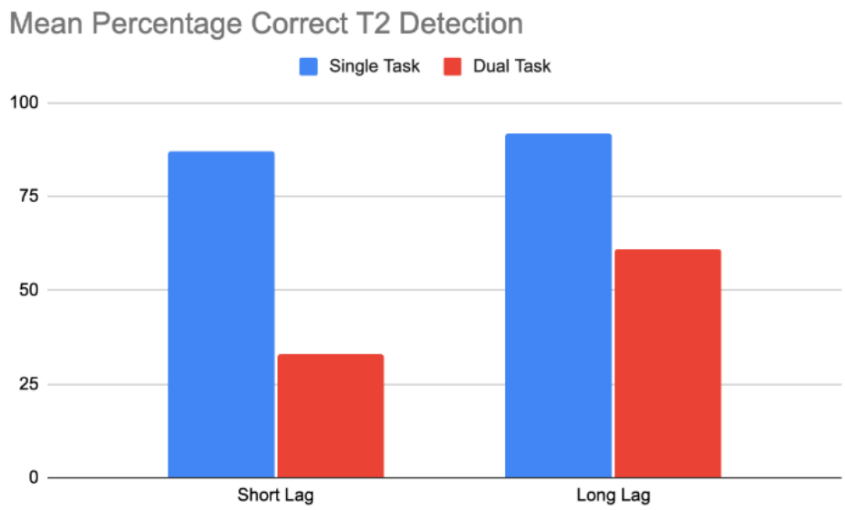
Results

The results were converted into percentages and presented in a table and a bar chart. Percentages were calculated by averaging the results across all four conditions.

Figure 1.
Percentage of correct T2 detection in the single-task and dual-task conditions.
Adapted from lecture slides.

%	Short Lag	Long Lag
Single Task	87	92
Dual Task	33	61

Figure 2.
Percentage of correct T2 detection at short and long lags.
Adapted from lecture slides.



As shown in Figure 1, in the single-task condition T2 was detected at a rate of 92% at the 700 ms lag. At short lag, T2 was detected at a rate of 87%. In the single-task condition, both lags resulted in high T2 detection. T2 detection was slightly higher at the long lag than at the short lag in the single-task condition. In the dual-task condition, T2 detection accuracy was lower than in the single-task condition.

In the dual-task condition, T2 was detected at a rate of 33% at the short lag. This represents a decrease in T2 detection in the dual-task condition. In the dual-task condition, T2 detection was lower than in the single-task condition. At the long lag,
T2 detection in the dual-task condition was 61%, compared with 92% in the single task condition. T2 detection increased from short lag to long lag in the dual-task condition.

Overall, T2 detection was lower at short lags than at long lags. This pattern was observed in both the single-task and the dual-task conditions. As shown in Figure 2, T2 detection was lower at short lags than at long lags in both task conditions. The difference between short and long lags was smaller in the single-task condition and larger in the dual-task condition.

Discussion

Our results demonstrate the presence of an attentional blink effect. The results showed that T2 detection

decreased at short lags. T2 detection was lower at short lags in both the dual-task and single-task conditions. This pattern was also illustrated in the figures, where T2 detection was lower at short lags than at long lags. These findings support the hypothesis.

Our results are consistent with the attentional blink effect reported by Raymond et al. (1992). The findings are also consistent with the two-stage processing theory. Our results are consistent with the attentional blink effect reported by Raymond et al. (1992). The findings are also consistent with the two-stage processing theory.

This may occur because attentional resources are engaged in processing T1, which reduces the likelihood of detecting T2. Jensen et al. (2011) also suggested that attention is a limited resource, meaning that T1 and T2 cannot always be processed simultaneously. This idea is also consistent with Broadbent's Early Selection Theory (1958). Attention acts as a filter, meaning that processing resources are allocated to T1 and T2 may be filtered out. This may explain why T2 was not detected in some trials of the experiment. This finding is also consistent with Simons (2000), who suggested that salient stimuli do not always capture attention. This finding may also relate to the idea that the attentional system suppresses irrelevant information in the environment (Thakral & Slotnick, 2010). However, the results suggest that the attentional system struggles to process the second target while processing the first target, as shown by the reduction in T2 detection. Bressan and Pizzighello (2008) also suggested that stimuli may still be processed by the attentional system even when they are not consciously perceived. However, this aspect was not directly examined in the present experiment. These findings provide further support for the attentional blink phenomenon described in previous research.

Future studies could examine additional lag intervals. This could help determine more precisely when attentional blink occurs. Future studies could also examine attentional blink using different types of stimuli, such as numbers, images, or shapes.

This may provide further insight into how attentional blink occurs under different conditions. A larger sample size could also improve the reliability of the findings.

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