RESEARCH ARTICLE

Attentional Blinking in University Students

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ABSTRACT

Attentional blinking (AB) is a limitation in temporal attention in which individuals struggle to process two rapidly presented stimuli, typically examined using rapid serial visual presentation (RSVP) and stimulus onset asynchrony (SOA). This study investigated AB in undergraduate behavioural science students using a quantitative within-subject design. A total of 385 participants completed a computer-based task requiring identification of two target stimuli presented in quick succession. It was hypothesised that accuracy would be lower for the second stimulus than the first, with second-target accuracy around 50%. The results supported this hypothesis, showing higher accuracy for the first stimulus and reduced accuracy for the second, which remained above 50% with substantial variability. These findings confirm the presence of attentional blink in this population. Future research should examine individual differences, reaction time, and fatigue effects, with implications for education and visually demanding occupations.

Keywords: *Attentional blinking, stimulus onset asynchrony*

Introduction

Attentional Blinking (AB) refers to the misidentification of a stimulus when two stimuli are presented in quick succession, generally within 200 to 500 ms, with the second stimulus being the one that is most often misidentified (Shapiro et al., 1997). One of the most common measurements used to measure AB is Rapid Serial Visual Presentation (RSVP), where observers are told to report a target stimuli, generally the second stimuli, after their shown multiple stimuli rapidly (Raymond et al., 1992).

Many have tried to explain why this phenomenon occurs. A common explanation is the Inhibition Theory from Raymond et al. (1992), where they explained that perceptional uncertainty and confusion occur when two target stimuli are presented in quick succession. Giesbrecht and Di Lollo (1998) also tried to explain using the Delay of Processing Theory, where the likely cause of AB is that a person is busy processing stimulus 1 when stimulus 2 is shown.

Many experiments have been done to confirm whether this phenomenon exists or not. Tsurumi et al. (2021) conducted a study testing attentional blink on infants aged 7 to 8 months using RSVP. They showed infants a sequence of images rapidly, with face images as target stimuli shown twice within a 200 ms delay and an 800 ms delay. They found that infants were more likely able to identify the first target stimulus but failed to identify the second target stimulus on the 200 ms test, proving the AB phenomenon. However, on the 800 ms test, infants were able to identify both target stimuli.

Maciokas & Crognale (2003) conducted a similar study comparing AB between young (18-27 years old) and old (64-79 years old) participants. Participants were shown nine items per second, with target stimulus 1 and target stimulus 2 shown within an 1180 ms delay. They asked the participants to first report only target stimulus 2, then asked them to report both targets. The result showed a low AB deficit in young adults, which gradually grows the older the participants.

These two pieces of literature not only supported the existence of the phenomenon but also showed us that this phenomenon happens across all ages. This study seeks to further support and add to this evidence by testing whether this phenomenon happens to university students. In this study, we hypothesized that the AB phenomenon does exist and is a significant phenomenon that affects university students. More specifically, we hypothesized that participants would more accurately detect target stimuli when it was shown first rather than when it was shown second. The average accuracy of when the target stimuli were shown the second time is hypothesized to be above 50% but below the accuracy of when the target stimuli were shown the first time.

Method

Participants

This experiment involved 385 participants (297 females, 78 males, 4 non-binaries, and 6 preferred not to answer). The participants were Bachelor students from Queensland University of Technology who took the course Perception and Cognition. Informed consent was not obtained as the study is a part of the course the participants take part of. All information obtained and collected are kept anonymous to protect the identity of participants. Participants who do not wish to take part of the study can choose to leave or not attend the class.. All participants took the same test. No additional selection criteria were applied for participation in the experiments.

Design

Much like experiments conducted by Tsurumi et al. (2021) and Maciokas & Crognale (2003), this experiment used a form of RSVP to test the AB of participants. This experiment was conducted with a within-subject design. Within-subject design was used as there was only one condition to be given to participants. Within-subject design is also commonly used in attention and reaction time studies, which is the topic of this study. The independent variable was the delay between two visual stimuli. There was only one level for the independent variable, with a delay of 200 ms between each stimulus. There were four possible positions of target stimuli, which, including the absence of the target stimuli, resulted in five

combinations. Participants conducted a total of 60 trials, with random variation on target stimulus position, order of appearance, absence of target stimulus, and delay between two stimuli. The dependent variable was how often participants were able to identify the correct stimulus and how often participants missed the stimulus due to attentional blinking.

Apparatus

The experiment was conducted on a computer that was connected to an internet connection. Participants had the option to conduct the experiment on their own personal laptop or from a computer provided by the university. This means that the devices used by each participant differ from each other. Generally, the devices used have a resolution of 1920x1080 with a 60Hz screen and a keyboard. Participants were also given the option to conduct the experiment in a provided room or at home.

Procedure

Participants would open a website where the experiment is administered, made using PsyToolkit (Stoet, 2010; Stoet, 2017). The website first showed the instructions for the experiment. Once the participants were ready, they were then given a screen showing a dot in the middle with four boxes on the top, right, left, and bottom of the dot. The stimuli were a combination of a corner of a square, and participants were told to identify the target stimulus resembling the letter "L.". After the participants pressed the spacebar key, a trial would start. In each trial, two random stimuli were shown randomly inside two boxes. After a stimulus was shown, it was immediately masked in a way where the stimulus was hidden. After a delay, the second stimulus was then shown and masked the same way. The delay between the first and second stimulus was mostly around 200 ms, but the delay was also randomized to be up to 800 ms to make sure participants were not used to the usual delay. The participants were tasked with identifying whether one of the two stimuli shown contained the target stimuli, in which they pressed "b" if there was a target stimuli or "n" if there were no target stimuli. The participants were given up to 5 seconds to decide, in which case if they did not give an answer, it would count as a fail. The participants repeated this trial 60 times.

After participants finished the experiment, they were then given a score on how accurate they were in identifying the target stimulus as a percentage, as well as their performance when the target stimulus was shown first compared to when the target stimulus was shown second. Participants were then asked to input their result in an Excel sheet alongside their gender. The Excel sheet then takes all of the participants' input and averages it. The averages were then used to calculate the data.

Discussion

The study seeks to prove the AB phenomenon in university students when presented with two visual stimuli in RSVP in varying SOAs, mostly at 200ms.

The results showed participants do appear to show AB at SOA ranges of 200 to 600ms, showing accuracy percentage of 50% and above. The detection accuracy falls when target stimuli is shown second rather than first, suggesting that order of presentation matters. Even so, the difference is significant.

The data consisted of the accuracy of identifying target stimuli measured in percentage. Shown in Table 1. the accuracy of the stimulus being shown first (M=64.51, SD=20.99) is higher than the stimulus being shown second (M=58.91, SD=19.16), supporting the hypothesis. However, the standard deviation is quite large, indicating a wide variance in data. This could mean the accuracy score could either be inflated or deflated due to the high variance of scores. A paired sample t-test was used to compare the data on the two conditions (N= 384, M=5.61, SD=22.93). It showed that there was a significant difference in the accuracy ($t(384) = 4.795$, 95% CI [3.30, 7.90], $p < 0.001$) between the stimulus being shown first and second.

This study has found that accuracy dropped when the target stimulus appeared second, which supports existing core AB research. Classical studies (Raymond, Shapiro & Arnell, 1992; Chun & Potter, 1995) demonstrated that when two targets appear within 200–500 ms, T2 detection is impaired due to limited attentional resources. As such, the present findings align with this theoretical claim that participants struggled more to perceive the second target at the 200-ms SOA, indicating the presence of an attentional bottleneck.

Chun and Potter's (1995) two-stage model offers a strong explanation for this effect. According to the model, attention engages deeply with T1 during early encoding and consolidation. While this occurs, resources for T2 are temporarily unavailable. Thus, at a 200-ms interval, T2 processing suffers. The observed decline in T2 accuracy in this study is consistent with this explanation.

It is noted that the small difference in detection between stimuli being shown first and second is different than past research. A possible explanation for lower detection accuracy on second presentation may be the similarities in stimuli, as both target stimuli and distractor stimuli are based on corners of a square. There may also be factor of familiarity with digital stimuli, which may affect participants' ability in detecting target stimuli. As such, from the mild difference in detection range, it may be possible that participants experience a "mild blink". This finding is still theoretically meaningful, as modern AB research has documented variability in blink magnitude across individuals, cognitive strategies, and presentation contexts (Olivers & Meeter, 2008).

Results

The results of this study support existing theories on the temporal limitations of attention, including the two-stage model and the boost-and-bounce theory, and confirm that university students experience attentional blink when exposed to rapidly presented sequential stimuli. The findings also highlight the influence of target order on performance, demonstrating reduced accuracy for the second target, consistent with previous attentional blink research.

The hypotheses were partially supported. Although the mean accuracy for the second target was approximately 50%, it was higher than initially predicted. Furthermore, the expectation that accuracy would be higher when the target stimulus was presented first rather than second was not supported, suggesting that attentional processing during rapid stimulus presentation may be influenced by additional task-related factors.

Future research should examine individual differences such as gaming, athletic, or meditation experience, analyse reaction time across different SOA intervals, and investigate the effects of mental fatigue. Practically, these findings may inform strategies to reduce information overload in educational settings, guide interface design in computing and internet applications, and support occupations that require rapid visual monitoring by acknowledging human attentional limits.

DECLARATION OF POTENTIAL CONFLICT OF INTEREST

"Haykal Afkar does not work for, act as a consultant for, own shares in, or receive funding from any company or organization that may benefit from the publication of this manuscript."

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Apparatus

Table 1

Accuracy of target stimulus identification (%)

Condition	*M*	*SD*
Stimulus shown 1st	64.514	20.986
Stimulus shown 2nd	58.909	19.164

Note. *M* = mean; *SD* = standard deviation.

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Target1 - Target2	5.60519	22.93458	1.16885	3.30704	7.90335	4.795	384	<.001	<.001