COGNITION
Research Report

The negative effect of doodling on visual recall task performance

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Abstract

Doodling consists of drawings that are often made to pass the time while an individual's primary attention is elsewhere. Therefore, it is often seen as a sign of lack of attention. Studies have shown that doodling can actually be beneficial to recall performance on auditory tasks since it does not require many executive resources and may serve to stop mind wandering without affecting attention on the main task (Andrade, 2009). To date, there have been no studies investigating whether recall performance is affected when the primary task requires the same modality as doodling; the present study aimed to determine whether doodling would affect performance on a visual recall task. Participants (N = 14) were randomly assigned to either 'doodling' or 'non-doodling' conditions. Both groups observed a collection of images that they were then instructed to recall from a second list presented directly afterwards, with the 'doodling' group instructed to doodle while observing the first set of images. As hypothesized, the mean number of recalled images by the doodlers was found to be significantly lower than that of the non-doodlers. This was likely due to the fact that doodlers' visual processing resources were divided between the two tasks. An implication of this finding is that multitasking in activities which require the same primary modality as that of the main task can have a negative effect on the amount of information processed and retained.

Keywords: *doodling, modality, visual processing, recall, multitasking*

A doodle is a drawing that is made while a person's primary attention is elsewhere. It can consist of cartoons, landscapes, geometric shapes and/or lettering. Doodling is often done to pass the time when one is bored or while daydreaming. An example of doodling can be seen in schools on students' lecture notes. Whether doodling impairs performance by detracting resources from the primary task or whether it can improve performance by maintaining concentration is currently being questioned.

While doodling has long been associated with a lack of attention on the task at hand, such as an ongoing lecture, some studies have shown that doodling actually improves recall performance. In one such study, forty participants listened to a monotonous mock telephone message containing the names of people coming to a

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party. The researchers randomly assigned half of the group to a doodling condition in which they shaded printed shapes while listening to the message. Unexpectedly, the doodling group performed better on the task and recalled 29% more information on a surprise memory test than the non-doodling group (Andrade, 2009).

Unlike many dual task situations, doodling while working may be beneficial because it is thought to improve attention to the primary task by reducing mind wandering such as daydreaming, which requires more executive functioning than doodling (Andrade, 2009). A simple task such as doodling requires very few executive resources and may be sufficient to stop daydreaming without affecting attention and processing of information – therefore performance – on the main task (Andrade, 2009). Another study proposed that doodling is beneficial for attention to a primary task by being a way for students to address their need to be active when they are forced to be inactive in a confined space such as a classroom setting. By acting as an outlet for this tension, doodling allows the student to focus on the class lecture (Aellig, Cassady, Francis, & Toops, 2009).

However, doodling may only be beneficial in dual task situations where the two tasks do not compete for the same information processing resources. After being viewed, images must travel from the eyes through the optic nerve to the lateral geniculate nucleus of the thalamus. From there, this signal is sent to the visual cortex, where it is further processed. For example, the ventral stream of the visual association cortex, or the "what" stream, plays a role in recognition and identification of visual stimuli. The dorsal stream, or the "where" stream, helps to guide visual attention. When a person engages in tasks that demand the use of both of these pathways, information may not be processed to the same degree as when there is solely one visual task because the capacity of the visual system is limited (e.g., Broadbent, 1958; Kastner & Ungerleider, 2000).

To the author's knowledge, no previous studies have investigated the effects of doodling on recall on a primary task which requires the use of the same primary modality, such as the recall of objects. Therefore, as doodling and viewing objects both require visual processing, this study will investigate whether or not doodling affects recall on a visual task. Participants will be randomly assigned to the 'doodling' and 'non-doodling' conditions and instructed to memorize a slideshow of images, with those in the 'doodling' condition instructed to doodle. They will then be presented with a second slideshow and asked to identify the images that were in the first slideshow. Since doodling will compete for the visual processing resources necessary for the primary recall task, it is hypothesized that doodlers will do worse than non-doodlers on the visual recall task by recalling fewer images than the non-doodlers.

Method

Participants

Fourteen undergraduate students from the University of British Columbia participated in this study. There were ten females and four males, with an average age of 19.79 years (SD = 1.19). Participants were enrolled in the PSYC 260 course and recruited as volunteers.[1]

[1] As this experiment was conducted as part of a course project, ethics approval was not needed.

Materials

Microsoft Office PowerPoint 2007 was used to present the two slideshows of images for the visual recall task. The two lists of images and the order they were presented in are shown in Supplementary Table 1. The images were found on the internet. The slideshows of images were all presented in colour on the full screen setting of a 15.4" Toshiba laptop. For the duration of the study, each participant was seated at a table with the laptop directly in front of them, with sufficient table space on which to use the paper and pen provided.

Procedure

At the beginning of the experimental task, half of the participants were randomly assigned to the 'doodling' condition based on the order in which they took part in the study. All participants were instructed to view the first slideshow (List 1) and to try to memorize all of the images that would be presented. Participants in the 'doodling' condition were given the additional instruction to draw flowers (an arbitrary, relatively simple image) on the piece of paper provided at the same time as they were viewing the slideshow. They were told that they could look at their doodling as they wished, and not to stop drawing until the slideshow was over. Directly afterwards, all participants were told to view the second slideshow (List 2) and, as they watched, to indicate on the paper provided which images in List 2 also appeared in List 1. There were twenty images in each slideshow, and ten of the original twenty images from List 1 were in List 2 along with ten new images (Table 1). However, participants were not told how many of the images from List 1 would be in List 2. Each image in both slideshows was presented once and shown for three seconds.

The experiment was conducted between-groups, and each participant was individually tested. The independent variable was doodling, and the dependent variable was the number of images correctly identified in List 2 as being from List 1. Participants were scored on correctly indicating whether or not each image in List 2 was present in List 1 for a total maximum score of 20 (i.e., participants were given a point for correctly identifying when an image in List 2 was or was not presented in List 1).

Results

A between-groups, independent samples t-test was conducted to test for a difference in the average number of images recalled in the visual task between the 'doodling' group and the 'non-doodling' group. As shown in Figure 1, the mean number of recalled images by the doodlers (M = 15.86, SD = 1.07) was significantly lower than that of the non-doodlers (M = 19.29, SD = 1.11), t (12) = 5.88, p< .001.

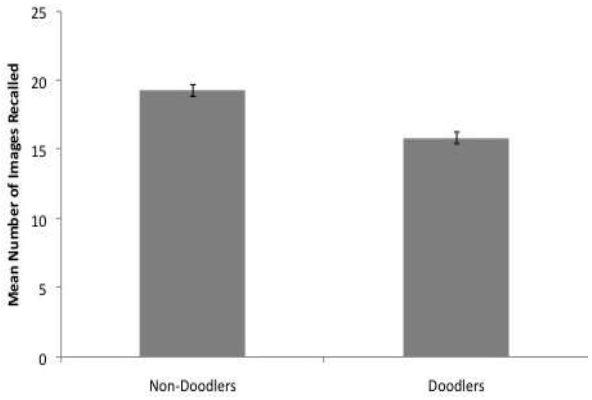

Figure 1. Mean number of images recalled ± standard error of participants (n=14) in the 'doodling' and 'non-doodling' conditions. Non-doodlers (M = 19.29, SE = 0.42) had a significantly higher mean number of images recalled in the visual task than doodlers (M = 15.86, SE = 0.40).

Discussion

As hypothesized, there was a significantly higher mean number of images recalled by the non-doodlers than by the doodlers, which suggests that doodling negatively affects performance on the visual recall task. This is likely a result of the fact that as both doodling and the main visual recall task required visual processing by the brain, performance on the recall of images was impaired. In a similar fashion, Andrade (2009) noted that tests of memory or attention often use a second task to selectively block a particular mental process, and if that process happened to be important for the main cognitive task, it would result in performance being impaired due to this competition for cognitive resources. As well, all doodlers were observed to glance at their doodles from time to time throughout the slideshow, which detracted from the time that could have been spent looking at and memorizing the pictures. Therefore, it is possible that doodlers viewed the images for a shorter duration of time than non-doodlers.

A further explanation for these results could be that the 'doodling' condition evoked the effects of multitasking on performance since doodlers had to doodle at the same time as memorizing the images in the slideshow that was presented. Multitasking requires attention to be divided between simultaneously occurring tasks, and after much research (e.g., Broadbent, 1971; Hembrooke & Gay, 2003), it has been shown almost without exception that performance on one or both tasks suffers as a direct result of having to perform two tasks simultaneously (Hembrooke & Gay, 2003). This effect may be explained by Broadbent's theory of selective attention which proposed that after sensory processing, information is filtered through a limited processing channel that can become overloaded (Broadbent, 1971). When this happens, some of the incoming information is filtered out, while other information is selected for further processing (Broadbent, 1971). If this is indeed the case, some of the information from the visual recall task could have been filtered out and not processed by the brain into short term or working memory as a result of engaging in doodling. It is assumed that performance on a recall task, measured in terms of accuracy in recall, reflects the depth of processing of the monitored material (Andrade, 2009).

A potential confound for this experiment arises in how participants were told prior to the task that they would be tested on recall. As a result of this, participants had incentive to focus on the images and devote their attention to the task, thereby resisting from any mind wandering, such as daydreaming, that may occur in a natural setting. Another potential confound lies in how the images in the slideshows were not strictly neutral and could have generated some emotion or memory in the participants, which could have affected recall. In the future, the images could be selected from a list of pre-determined neutral images.

In the present study, although all participants assigned to the 'doodling' group were instructed to draw pictures of flowers as a way of standardizing doodling, every participant had their own interpretation of these instructions, and hence, all the doodled images of flowers were different. In order to better standardize the doodling condition, a sample image of a flower could be given to participants to copy or the doodling task should be even more simplified (i.e., participants instructed to draw a simple shape such as a square). This

would also make the task of doodling more "mindless" and allow more cognitive resources to be devoted to the primary recall task. Furthermore, participants were allowed to look at their doodling as they wished and the viewing time of each participant to the slideshow images was therefore inconsistent and uncontrolled. More precise instructions in future studies would help to minimize confounds. However, in the interest of standardizing the experiment, a limitation to the implications of the findings exists in how participants' doodling is unnatural since they are not allowed to draw as they please; doodling is typically done at one's own discretion.

Important implications of this study focus around methods of aiding attention and memory. In previous research, such as that of Andrade (2009), auditory tasks were chosen to be the main cognitive tasks in order for doodling to compete minimally for modality-specific resources, and resulted in doodling being found to improve recall. The findings of the present study further develop this idea by showing that doodling does not remain beneficial for performance on a primary task when it competes for the same cognitive resources. Therefore, it could be generalized that in order to improve information processing and memory, one should not multitask in activities which require the same primary modality as that of the task. This has practical applications for real-life activities, such as studying, and for behaviour in class lectures and during meetings in the workplace. It is plausible that multitasking could be beneficial if the secondary task serves to reduce mind-wandering while not detracting from the cognitive resources necessary for the primary task (Smallwood, O'Connor, Sudbery, & Obonsawin, 2007). A future study could explore whether an auditory secondary task that uses minimal executive resources and does not compete for visual resources, such as listening to music without lyrics, would be beneficial for performance on a visual recall task. To further specify findings, future studies using larger sample sizes could also investigate whether sex differences play a role in the effect of a secondary task on main recall task performance (i.e., doodling on audio recall task performance) as it has been shown that there may be sex differences in the ability to multitask (Ren, Zhou, & Fu, 2009). Continued research on the effects of a secondary task on a primary recall task will allow students and professionals alike to adopt work habits that can help to maximize information processing and recall, thus increasing time efficiency and productivity in their everyday lives.

Declaration of Conflicting Interests

The author declared they have no conflicts of interests with respect to their authorship or the publication of this article.

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Supplementary Material

Table 1. Images presented in List 1 and List 2.

Order of images	List 1	List 2
1	Tropical island	City (List 1)
2	City	Beach
3	Pink flower	Pink flower (List 1)
4	Airplane	Piles of wood (List 1)
5	Wooden loom	Colourful water droplet
6	Tree trunk	Oak tree in sunset
7	Kite	Snail (List 1)
8	Fighter jet	Purple flower
9	Purple flower petal	Rocks
10	Snail	Kite (List 1)
11	Bed	Pile of marbles
12	Brick wall	Butterfly
13	Various slate patterns	Tree trunk (List 1)
14	Water droplet	Snow-covered landscape
15	Palm tree in sunset	Bookcase (List 1)
16	Piles of wood	Purple flower petal (List 1)
17	Multicoloured swirl	Toy wagon
18	Wagon	Fighter jet (List 1)
19	Pile of beads	Window
20	Bookcase	Multicoloured swirl (List 1)