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What does doodling do?

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Doodling is a way of passing the time while focused on a primary task. Does it improve or harm attention to the primary task? To answer this question, 40 participants monitored a monotonous mock telephone message for the names of people coming to a party. Half of the group was randomly assigned to a 'doodling' condition where they shaded printed shapes while listening to the telephone call. The doodling group performed better on the monitoring task and recalled 29% more information on a surprise memory test. Unlike many dual task situations, doodling while working can be beneficial. Future research could test whether doodling aids cognitive performance by reducing daydreaming or helping maintain optimal levels of arousal.
What does doodling do?

The call centre has put you on hold yet again and you start thinking about how good it would be to have a holiday, where you would like to visit... then you realize that the person you have been waiting to speak to has started talking and you haven't taken in anything they've said. This scenario demonstrates the tendency for daydreaming to start in moments of boredom and, once started, to distract attention from the task in hand. In such a situation some people resort to doodling, aimlessly sketching patterns and figures unrelated to the primary task. It is not known whether doodling impairs performance by diverting resources from the primary task, or whether it improves performance by aiding concentration (e.g., Aiken, 2004). The question is one that may arise in research on attention and vigilance. Boredom is a very common experience (Harris, 2000) and daydreaming is a common response. It is in the laboratory (Smallwood & Schooler, 2006) or outside in the laboratory (Driscoll, 2006). A way of aiding concentration and improving performance for psychological research is to use a secondary task as a control. Dual task designs are commonly used to study how specific cognitive resources affect performance, but they fail to account for daydreaming. Performance decrements in conditions when only the primary task is controlled may be attributed to the secondary task, but the need for dual-task methodology to understand the contribution of daydreaming to this decrement is not adequately addressed in single-task conditions (Driscoll, 2006).

This study is the first experimental test to examine the prediction that doodling aids concentration. Participants listened to a monotonous mock telephone message. The audibility and visual cues of the speech and modulation of voice and pitch were manipulated to ensure that the participants were able to attend to the primary task while they listened to the message. Participants sat in a laboratory environment and listened to the message. They were asked to complete a secondary task of drawing while listening to the message. The results showed that participants who drew while listening to the message had better performance on the secondary task than those who did not draw. These findings suggest that doodling may improve concentration, which has implications for psychological research methods and practical applications.
afterwards attempted a surprise recall test for that information and for incidental information. Performance was measured in terms of monitoring accuracy and memory, which was assumed to reflect the depth of processing of the monitored material. Rather than being asked to doodle freely, participants were asked to shade in printed shapes on the response sheet, without worrying about the speed and neatness of their shading. The hope was that the simplicity of this shading task would not cause a decrement in participants’ ability, who in fact were drawing under conditions similar to those used in previous studies. Participants were instructed to shade their drawings slowly, and to do so in a way that would encourage a degree of absent-mindedness in participants' drawing, akin to that seen in naturalistic doodling. Participants were not asked to doodle freely in case they felt self-conscious about their drawings or suspected that the content of their doodles was the real focus of the study. Rather, they were asked to shade in a way that would encourage a degree of absent-mindedness in participants.

Method

Participants and design

Participants were 40 members of the MRC Applied Psychology Unit’s participant panel, recruited from the general population and aged between 18 and 55 years. They were divided into two groups: control (N = 20; 2 male) and doodling (N = 20; 3 male). All participants monitored a telephone message and attempted to recall monitored and incidental information. Recall order was counterbalanced across participants.

Materials

A telephone message was recorded onto audio cassette tape in a fairly monotone voice at an average speaking rate of 227 words per minute and played at a comfortable listening volume. The script included eight names of people attending a party, and names of three
participants were recruited just after finishing an unrelated experiment on ways of giving directions to different locations by another researcher, and were asked if they would like to spend another five minutes helping with research. The intention was to enhance the boredom of the task by testing people who were already thinking about going home.

Participants were tested individually in a quiet and visually dull room. They were told:

"I am going to play you a tape. I want you to pretend that the speaker is a friend who has telephoned you to invite you to a party. The tape is rather dull but that's okay because I don't want you to remember any of it. Just write down the names of people who will definitely or probably come to the party (excluding yourself). Ignore the names of those who can't come. Do not write anything else."

Participants in the doodling condition were also asked to shade in the squares and circles while listening to the tape. They were told, "It doesn't matter how neatly or how quickly you do this - it is just something to help relieve the boredom."

Participants listened to the tape, which lasted two and a half minutes, and wrote down the names as instructed. When the tape finished, the experimenter collected the response sheets, and engaged participants in conversation for 1 minute including an apology for misleading them.
them about the memory test. Half the participants then read the names of party-goers and places mentioned in the tape. The other half read the places first, followed by the names. During debriefing, participants were asked if they had suspected a memory test.

Results

Participants in the doodling group shaded a mean of 36.3 of the printed shapes on their response sheet (range 3 to 110). One participant did not doodle and was replaced. Participants in the control condition did not doodle. Three doodlers and four controls suspected a memory test. None said they actively tried to remember information.

Control participants correctly wrote down a mean of 7.1 (SD = 1.1) of the eight names of party-goers during playback of a tape read aloud. Doodling participants correctly wrote down a mean of 7.8 (SD = 0.4) names of party-goers during playback. No participant made more than one incorrect name.

Plausible mishearings, such as 'Greg' for 'Craig', were scored as correct. Other names that were not mentioned on the tape were scored as 'incorrect'. For analysis, monitoring performance was scored as the number of correct names written down. Monitoring performance in the control condition (mean = 6.9, SD = 1.3, Mann-Whitney U = 124, p = 0.01 one-tailed) was significantly higher than in the control condition (mean = 7.7, SD = 0.6).

Recall performance was scored separately for names and places using the definitions of correct responses and false alarms above. Participants also specified their recall protocols during debriefing.

For the name recall monitoring and recall phases, see Table 1 (overall participants).
doodling condition recalled a mean of 7.5 pieces of information (names and places), 29% more than the mean of 5.8 recalled by the control group. Memory scores were entered into a 2 (doodling, control) by 2 (names, places) mixed measures ANOVA which confirmed that the monitored names were recalled better than the incidental places (F(1,38) = 54.9, p < 0.001). Recall was better for doodlers than controls, F(1,38) = 6.0, p = 0.02, for both monitored and for incidental information (interaction F < 1). Removing data from participants who had suspected the nature of the study resulted in a trend (main effect of group: F(1, 31) = 5.2, p = 0.03). Entering monitoring performance as a covariate had the group effect marginally significant, F(1,37) = 3.5, p = 0.07.

Discussion

Participants who performed a shape-shading task, intended as an analogue of spontaneous doodling, remembered a mean of 5.8 pieces that participants who listened to the message. This suggests that better recall for the doodling group was due to more engaged processing. When monitoring performance or incidental information was used as the group effect marginally significant, or there is no clear advantage doodling task. However, the advantage for the doodling group was significant (main effect of group: F(1, 31) = 3.5, p = 0.03). Entering monitoring performance as a covariate made the group effect marginally significant, so it is not clear whether doodling led to better recall simply because doodlers noticed more of the target names or whether it aided memory directly by encouraging deeper processing of the material on the tape.

Two methodological features may have contributed to the beneficial effect of doodling by making the primary task more interesting. First, participants were recruited immediately after they had finished another colleague's experiment. The intention was to test people when they were more prone to boredom than if they had just arrived at the laboratory, although there is no evidence that this was the case. If you have not felt that the doodling task was uninteresting and not searching for something to search, deciding in the material for the doodling task was described as a way to engage people in the experiment. It encouraged
participants to do it in a fairly naturalistic, automatic fashion. The instructions contained no suggestion that it would improve cognitive performance. It remains to be discovered whether the benefits of the shading task extend to naturalistic doodling.

What mechanism might underlie the effect of doodling on concentration? One possibility is that doodling simply helps to stabilize arousal at an optimal level by keeping people awake or reducing the high levels of autonomic arousal often associated with boredom (London, Schubert & Washburn, 1972). Future research using psychophysiological measures might pick up such effects. A more specific hypothesis is that doodling aids concentration by reducing daydreaming, in situations where daydreaming might be more detrimental than drawing itself. Functional brain imaging techniques have shown high levels of default-mode network activity in self-reported daydreamers (Mason et al., 2007), consistent with it being a high-level cognitive activity that might disrupt concurrent task performance. Functional brain imaging confirms that daydreaming is associated with medial prefrontal cortex activation similar to that observed during semantic processing (Binder et al., 1999), consistent with it being a high-level cognitive activity that might disrupt concurrent task performance (Smallwood & Schooler, 2006; Teasdale, Proctor, Lloyd & Baddeley, 1993). Functional brain imaging methods have shown that doodling may reduce default-mode network activity (Smallwood, O'Connor, et al., 2007), consistent with it being a high-level cognitive activity that might disrupt concurrent task performance. Doodling may reduce default-mode network activity by occupying the available resources required for this activity.
with Smallwood et al’s (2007) hierarchy, in which mind wandering occurs less frequently during tasks that demand greater interaction with and retention of external stimuli. The message monitoring task would have encouraged daydreaming because the resource demand of the basic task was low. Because participants were not told about the forthcoming memory test, they had little incentive to ‘catch’ themselves daydreaming and return their attention to the task. However, performance on the memory task would have presumably benefited from deeper processing of the stimuli and greater time spent on task, i.e. less daydreaming.

A more specific hypothesis is that doodling prevents daydreaming by shifting the overall resource load from engaging cancel external resources to an extent that would otherwise place the demands on existing memory. Even quite small adding memory loads from daydreaming (Crum & Smallwood, 2009) can render tasks that are redundant with drawing or doodling distracting rather than improving primary task performance. Because it is a concomitant of secondary task performance, it is possible that a small increase in working memory load would reduce the tendency to daydream. Doodling is relatively undemanding of general executive resources, being self-paced, repetitious and involving little controlled processing such as performance monitoring or inhibition of irrelevant information. Combining a visuo-spatial task like doodling with an auditory task should engage a similar degree of central executive resources needed to coordinate verbal and visuo-spatial short-term memory (Baddeley, 1996). It is hypothesized that the combination of external resources had little impact on working memory performance, because it was relatively undemanding of general executive resources and involved little controlled processing. Combining a visuo-spatial task like doodling with a memory task should engage central executive resources needed to coordinate verbal and visuo-spatial short-term memory. It is hypothesized that this continual but small central executive load detracts minimally from the primary auditory task yet is sufficient to prevent the greater impairment to performance that would be caused if central executive resources were free for daydreaming.

The present finding that doodling aids concentration and explaining the potential mechanism for this has important implications. The extent to which secondary tasks have beneficial effects or fail to have predicted detrimental effects is a ‘file drawer problem’, though a recent
paper by Roche et al. (2007) reports unexpected benefits of secondary tasks on visuomotor learning that were not due to increased arousal. Understanding the role of boredom and daydreaming, and tasks that alleviate them, would allow a more complete cognitive analysis of task performance in the laboratory setting and in real-life work and educational settings (Smallwood & Schooler, 2006; Smallwood, Fishman & Schooler, 2007). Ways of maintaining attention to task are also important in the context of depressive rumination and worry, where mind-wandering helps maintain dysphoric states (Smallwood, O'Connor et al., 2007).


Table 1. Mean recall results, false alarm probabilities and memory scores for the control and doodling groups for names and places.

<table>
<thead>
<tr>
<th>Group</th>
<th>Control</th>
<th>Doodling</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Names</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct</td>
<td>4.3 (1.3)</td>
<td>5.3 (1.4)</td>
</tr>
<tr>
<td>False alarms</td>
<td>0.4 (0.5)</td>
<td>0.3 (0.4)</td>
</tr>
<tr>
<td>Memory score</td>
<td>4.0 (1.5)</td>
<td>5.1 (1.7)</td>
</tr>
<tr>
<td><strong>Places</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correct</td>
<td>2.1 (0.9)</td>
<td>2.6 (1.4)</td>
</tr>
<tr>
<td>False alarms</td>
<td>0.3 (0.6)</td>
<td>0.3 (0.4)</td>
</tr>
<tr>
<td>Memory score</td>
<td>1.8 (1.2)</td>
<td>2.4 (1.5)</td>
</tr>
</tbody>
</table>
The boring telephone message: Monitored names are shown in **bold**, incidental places in *italics*.

"Hi! Are you doing anything on Saturday? I'm having a birthday party and was hoping you could come. It’s my friend’s birthday, not my own, but I’ll be 23. I’m thinking of doing Chinese for the main course and thought it would be nice to have beer to go with it. Please let me know if you think you can make it and we’ll book a table at the restaurant. I’ve also invited **William** and one of her old schoolfriends, **Claire**,** Jan**‘s boyfriend, but she doesn’t know that yet. I thought we could have a barbecue if the weather is nice, although the way it has been so far this week, that doesn’t look likely. I can’t believe it has got so cold already. We’ve had some really snowy days recently, although it’s not going to be as cold tomorrow. **Nigel** was going to join us but he has found out that he has to go to a meeting in **Penzance** that day and won’t be back in time. I thought we could have a barbecue if the weather is nice, although I’m not sure if it will be nice enough. **Suzie** is going to be there too. She’s the person I met at the pottery class in **Harlow** last year. Apparently she has got really good at it and may be having an exhibition of her work. We’re planning to bring some food - I’ve found a good recipe for punch - you warm up some red wine with gin and orange juice plus cloves and cinnamon. I’ve also found a good recipe for garlic bread. The boys from the house down the road are going to bring some wine and crisps. Please let me know if you can make it. I can’t wait to see everyone again."
the road have promised to bring some of their ingredients. There are three of them sharing the
house - John, Tony and Phil. John taught at a college together at Ely and now he teaches at a
primary school in Ely. Tony rents a room in one person's flat and commutes to Peterborough each
day. I think they both work in hospitals there. Tony was training to be a nurse at one point, but
is qualified now. He and John are both employed to be part of the teams looking after the
patients who need help. They have just finished another day like that. I think they have done enough
for today. I hope you are glad you are not going to stay over. Anyway, did I tell you about our
cation to Edinburgh? It was a complete disaster. We were camping and it rained constantly. We
spent most of the time in museums, trying to stay dry and comfortable. But then, to make matters
worse, Nicky got her handbag stolen. I was quite relieved to get back to work after that. Anyway,
I hope you can make it on Saturday - let me know if you want to stay over. Bye!