Gender Differences in Mind Wandering Intentionality

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Honors Research Project: Gender Differences in Mind Wandering Intentionality

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PSYCH 498 - 002: Honors Research in Psychology

Dr. Jennifer Tehan Stanley

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Abstract

The current study had two major goals. The first goal was to contribute to the replication crisis that the field of psychology is currently experiencing. My fellow research assistants and I attempted to replicate Seli and colleagues’ (2016) original study that first distinguished between unintentional and intentional mind wandering. The second goal was to answer my own research question regarding gender differences in mind wandering intentionality. I hypothesized that men would report higher levels of unintentional mind wandering than women. Participants were randomly assigned to two conditions of the sustained attention to response task (SART): difficult and easy. Within both conditions, intermittent thought probes appeared to each participant asking them to report intentional or unintentional mind wandering, if mind wandering at all. Using data collected from 29 undergraduate psychology students, we validated that the difficult SART is harder than the easy SART, we found no significant difference in overall mind wandering rates in both SART conditions, and we found a significant main effect of mind wandering type. However, we were unable to replicate a significant interaction between mind wandering type and condition that the original researchers had found. I analyzed the same data to answer my research question and found no difference in unintentional mind wandering between men and women. I found that men had higher variability in the unintentional probe response, which may be notable when considering gender differences in mind wandering intentionality. Future studies should be conducted to identify possible gender differences and variations in mind wandering.
Gender Differences in Mind Wandering Intentionality

What is mind wandering?

The topic of mind wandering is rapidly gaining popularity within the field of psychology. Everyone experiences mind wandering of some kind, whether it be beneficial, such as aiding in creative and critical thinking (Baird et al., 2012), or detrimental to everyday life, such as increasing the risk of an accident while driving (Knowles & Tay, 2002). The term “mind wandering” was first introduced by Smallwood and Schooler (2006), and it was defined as:

A situation in which executive control shifts away from a primary task to the processing of personal goals. Mind-wandering shares certain similarities with standard views of controlled processing, however, there is an important difference. Controlled processing is generally associated with the intentional pursuit of a goal. Mind-wandering, however, often occurs without intention . . . or even awareness that one’s mind has drifted. (2006)

This definition implies that mind wandering often occurs unintentionally. However, this raises questions about the intentionality of mind wandering. Can mind wandering occur because one intentionally chooses to engage in it?

Intentional vs. Unintentional Mind Wandering

Previous research has investigated mind wandering in many different contexts, but it has failed to define the intentionality of mind wandering, or lack thereof. Therefore, many researchers have come to believe that mind wandering is purely unintentional. A study conducted by Seli, Risko, and Smilek (2016) aimed to identify and differentiate unintentional and intentional mind wandering. These researchers felt that it was important to identify the intentionality of mind wandering because, “If unintentional and intentional forms of mind wandering are at least sometimes differentially influenced by certain factors or experimental
manipulations, this would present an important challenge to previous work and a new framework for future research aimed at understanding mind wandering” (Seli et al., 2016). The distinction between intentional and unintentional mind wandering is necessary to understand mind wandering fully.

**The Replication Crisis**

Currently, my fellow research assistants and I are working on a replication of Seli and colleagues’ (2016) original study in Dr. Stanley’s Emotions and Aging Lab at The University of Akron to contribute to reforming the replication crisis within the field of Psychology. It is our goal to conduct an exact replication of the original study. In 2015, conversations surrounding replication began to gain traction when psychologist Brian Nosek’s lab reported its outcomes after replicating 100 studies from three psychological journals. Researchers in this lab stated that they were unable to replicate a large portion of the findings (Woodell, 2020). This was significant to the field because it caused many to question the validity and reliability of research that was being published in academic journals (Woodell, 2020). Most believed that work published in psychological journals was trustworthy; however, these findings threatened that idea. Unfortunately, as more labs began to conduct replications, a large portion failed to replicate original studies (Woodell, 2020). Additionally, in 2015, news outlets reported a low estimate of a 36% replication rate within the field of psychology (Bradford et al., 2012). This issue became known as the replication crisis, and leaders in this field have sought to reform the lack of replication ever since.

As an undergraduate student, I believe that participating in a replication project such as this will help me develop my own research skills. The replication movement has offered many students, like me, great opportunities to gain research experience, to learn how research is
actually conducted, and to contribute something meaningful to psychological science. The current study that my fellow undergraduate research assistants and I are working on was provided to us by the Collaborative Replication and Education Project, which is associated with the Open Science Framework. Our study is one of 17 replications of the Seli et al., project, aiming to increase the validity and reliability of the results.

**Gender Differences in the Intentionality of Mind Wandering**

My personal research project adds another layer to the present study: Are there gender differences in the intentionality of mind wandering, specifically between men and women? One factor to take into account when discussing gender differences in mind wandering is the prevalence of Attention-Deficit/Hyperactivity Disorder (ADHD). The National Institute of Mental Health (NIMH) defines ADHD as an ongoing pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development. Studies show that there is a higher prevalence of ADHD in males than in females (Rucklidge, 2010). However, research on gender differences within this disorder suggest that females may be underdiagnosed because of a difference of expression of ADHD symptoms between males and females (Skogli et al., 2013).

In a study conducted by Mowlem and colleagues (2019), researchers evaluated mind wandering among males and females with and without ADHD. Using the Mind Excessively Wandering Scale (MEWS), the researchers in this study sought to assess differences in mind wandering between males and females, as well as ADHD symptoms, impairment, and wellbeing in individuals with and without ADHD (Mowlem et al., 2019). MEWS was recently developed and validated by these researchers as a new rating scale that reflects excessive mind wandering in ADHD. This scale has been found to have good internal consistency, high sensitivity, and the
ability to discriminate between ADHD cases and controls (Mowlem et al., 2019). The MEWS is reportedly comparable to existing ratings scales of ADHD symptoms that are used in clinical practice. Data from 1,484 participants, consisting of 425 males and 1,059 females ranging from 16-83 years old, were used. This study found no differences in mind wandering between males and females who have a diagnosis of ADHD. Additionally, no gender differences were found in levels of hyperactivity/impulsivity, emotional lability, or impairment among those with ADHD. However, the authors note that males with ADHD reported higher levels of inattention and lower well being than females with ADHD. Regarding participants without an ADHD diagnosis, males had higher scores across all ADHD-related scales and reported lower well being than females (Mowlem et al., 2019.). The present study not only aims to identify a gender difference in mind wandering, but it also aims to investigate a gender difference in the intentionality of mind wandering. Consistent with the finding of the Mowlem study, which states that men with ADHD reported higher levels of inattention and men without ADHD scored higher than women across all ADHD-related scales, I hypothesize that men will report higher levels of unintentional mind wandering than women in the present study.

Method

Participants

The present study is a replication of the Seli, Risko, and Smilek (2016) study, which investigated the intentionality of mind wandering. Working with the other undergraduate research assistants in Dr. Stanley’s lab, we recruited our participants through the University of Akron Psychology Department Research Participation System, also called SONA. Our participants consisted of undergraduate students currently in a psychology course that uses SONA for extra credit points. Our replication followed the same procedure as the original study;
however, there is one minor change that was added to participant demographics. The original study had two options for the gender of participants: male and female. In our replication, we had three options: male, female, and other. The present study included data collected from 15 males and 14 females, for a total of 29 participants. None of the participants selected “other” as their gender.

**The standard SART (difficult version)**

The sustained attention to response task (SART) measures the ability to sustain attention over a prolonged period of time. In this study, it was presented electronically using E-Prime 3.0 software (Psychology Software Tools, Pittsburgh, PA). In the difficult version of SART, digits 1-9 appeared randomly and one at a time on the screen. Participants in this condition were instructed to press the spacebar on the keyboard for each “go” digit (digits 1, 2, 4, 5, 6, 7, 8, and 9). Participants were instructed not to press the spacebar for the “no-go” digit (digit 3). After 18 practice trials, participants completed 900 experimental trials (Seli et al., 2016). Accuracy and reaction time were recorded (see Figure 1).

**The sequential SART (easy version)**

The easy version of SART was very similar to the difficult SART, except digits 1-9 were presented in numerical order. Participants in this condition were asked to press the spacebar on the keyboard for each digit except for 3; however, in this version, the appearance of 3 was completely predictable (Seli et al., 2016).
Figure 1.

*Sample of the difficult version of the SART*

This is what participants saw while completing the difficult version of the SART. Each number appeared on the screen briefly, followed by an “X.” Participants were instructed to press the space bar for each number except for “3.”

**Mind-Wandering Thought Probes**

We tested for mind wandering by using intermittent thought probes within both versions of the SART. When a probe occurred, the task stopped, and participants were asked the following question: “Which of the following responses best characterizes your mental state prior to the presentation of this screen?” The response options were “(1) On task,” “(2) Intentionally mind-wandering,” and “(3) Unintentionally mind-wandering” (Seli et al., 2016). Participants responded by pressing the key that corresponded to their answer to the question (keys 1-3). One probe was presented after every 45 trials, for a total of 20 thought probes. After the participant responded to each thought probe, the SART automatically resumed (Seli et al., 2016).
Procedure

We randomly assigned participants to complete either the difficult or easy version of the SART. A between-subjects design was used because of concern that previous exposure to one of the conditions might influence performance on the other.

This study was approved by the University of Akron Institutional Review Board (protocol number 20220311-C2). We presented each participant with a consent form, which informed them about the task. After signing the consent form, each participant was given instructions on how to complete the task. These instructions were the same for both conditions of the SART. Participants were also given instructions regarding the thought probes before beginning the task. They were told that:

being on task meant that they were thinking about things related to the task (e.g., thoughts about their performance, thoughts about the digits, or thoughts about their response),
whereas mind wandering meant they were thinking about something completely unrelated to the task (e.g., thoughts about what to eat for dinner, thoughts about plans with friends, or thoughts about an upcoming test). (Seli et al., 2016)

If the participant indicated that they experienced mind wandering, they were also asked to identify whether it was intentional or unintentional. The experiment took roughly 20 minutes to complete in total.

Measures

Our measures included no-go errors, go-trial response times (RTs), and mind wandering rates for both types of mind wandering (intentional and unintentional). No-go errors occurred when participants failed to withhold pressing the space bar when digit three appeared on the screen. Go-trial response times were measured by calculating the mean response latencies for all
go trials when the space bar was pressed. Mind wandering rates were the proportion of each type of response provided (intentional or unintentional mind wandering; Seli et al., 2016).

**Results**

In our attempt to replicate the original study, the first step was to determine whether the difficult SART was actually more difficult than the easy SART. Following the original study, my fellow research assistants and I measured each participant’s skill index by taking the mean no-go-trial accuracy and dividing it by the mean go-trial reaction time for each participant. We were able to validate that the difficult SART ($M=0.16$, $SD=0.06$) is harder than the easy SART ($M=0.38$, $SD=0.14$) by using an independent samples t-test in Jamovi 2.3, $t(28)=5.57$, $p<0.001$, $d=2.07$ (see Table 1).

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We also found no significant difference in overall mind wandering rates in both the easy SART condition and the difficult SART condition, $t(28)=0.59$, $p=0.558$, $d=0.22$ (see Figure 2). Overall mind wandering rates were computed by summing the rates of intentional and unintentional mind wandering (see Figure 2).
Figure 2.

Graph of overall mind wandering rates

This graph shows no significant difference in overall mind wandering rates in both the easy and difficult SART.

Additionally, we ran an ANOVA in Jamovi to attempt to find a significant main effect of the mind wandering type. We found more unintentional mind wandering than intentional mind wandering across conditions, $F(1,27)=21.31$, $p<.001$, $\eta^2=0.44$, meaning that we did find a significant main effect of mind wandering type. All of these results, thus far, are consistent with the original study. Finally, we attempted to replicate the significant interaction between mind wandering type (intentional or unintentional) and condition (difficult or easy SART) that the original study had reported. However, we did not find a significant interaction of the mind wandering type and the condition, $F(1,27)=0.043$, $p=0.838$, $\eta^2=0.002$; therefore, we were unable to replicate this result (see Figure 3).
My personal research question sought to identify possible gender differences in mind wandering intentionality. I hypothesized that men would report higher levels of unintentional mind wandering than women. I ran an independent-samples t-test to compare men and women’s responses to the thought probes, which asked them to report if they were “On Task,” “Intentionally Mind Wandering” or “Unintentionally Mind Wandering” using Jamovi 2.3. The results found no significant difference between men and women in unintentional mind wandering levels, $t(27)= 0.56, p=0.58$ (see figure 4).
Additionally, I explored gender differences in the “intentional” and “on task” responses. Using Jamovi 2.3, I found no significant difference in intentional mind wandering among men and women, \( t(27)=0.10, p=0.92 \) (see Figure 5), and no significant difference in the “On task” response, \( t(27)=0.29, p=0.78 \) (see Figure 6).
Figure 5.

*Intentional mind wandering probe response of males and females*

![Graph showing intentional mind wandering probe response](image)

Figure 6.

*On Task probe response of males and females*

![Graph showing on task probe response](image)
When examining the standard deviations of each probe response for men and women, I noticed that men had a higher standard deviation in unintentional mind wandering ($SD=3.14$), meaning that there was a lot of variance in the levels of unintentional mind wandering among men. Conversely, women had a higher standard deviation in intentional mind wandering ($SD=2.55$), meaning that women had more variability in intentional mind wandering. I found it interesting that the data for unintentional mind wandering in men are quite spread out (see Table 2).

**Table 2**

*Group Descriptives*

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**Discussion**

This research project aimed to both replicate Seli and colleagues’ original study and to identify a possible gender difference in mind wandering intentionality. Twenty-nine undergraduate psychology students were randomly assigned to two conditions of the sustained attention to response task (SART). During 900 trials of the task, intermittent thought probes appeared asking participants to report whether they were “On Task,” “Intentionally Mind Wandering,” or “Unintentionally Mind Wandering” (Seli et al., 2016). There were a total of 20 thought probes. Some of the original findings were replicated, including validation that the difficult SART is harder than the easy SART, no significant difference in overall mind wandering
rates in both SART conditions, and a significant main effect of mind wandering type. However, we were unable to replicate a significant interaction between mind wandering type (intentional or unintentional) and condition (difficult or easy SART) that the original researchers had found. This is likely due to the fact that we were only able to analyze the data from 29 participants, while the original study had 113. Studies are often not replicated, and there are many other reasons for this outcome, including user error, outlier analyses, and attention disorders. My fellow research assistants and I also hypothesize that we were unable to replicate the results because of the effects that the pandemic may have had on attention span, among other mental disparities. A study on attention and memory after COVID-19 found that attention span is at risk as a result of the pandemic (Velichkovsky et al., 2023). In fact, simply being concerned about the pandemic can have an effect, and active concerns about health and/or financial stability related to COVID-19 may interfere with sustained attention (Jun et al., 2021).

When considering gender and how it relates to mind wandering, I hypothesized that men would report higher levels of unintentional mind wandering than women. However, I found no significant difference in unintentional mind wandering levels between men and women. Additionally, I found no difference in the “Intentional” and “On task” probe responses between men and women. I believe that I was unable to find a significant difference because of the small amount of data that was analyzed from a sample size of 29. Interestingly, I found that men had a higher standard deviation than women in the unintentional mind wandering thought probe response, while women had a higher standard deviation than men in the intentional mind wandering thought probe response. This indicates high variability in the unintentional probe response among men, and high variability in the intentional probe response among women. Although this does not answer my research question, it is interesting to think about when
considering the levels of unintentional mind wandering in men versus women. Variability in the unintentional condition could indicate that there are some men in this sample who have ADHD who reported higher levels of mind wandering.

Working on this research project has taught me a lot about the research process and what goes into conducting a study. I learned about the importance of replication in psychological research, and I am honored to have been a part of the replication reform happening in this field. Although this project is not yet complete, Dr. Stanley’s Lab will continue with this replication. I decided to look at gender differences in mind wandering because I am interested in the effects of ADHD on male students. Few studies have been conducted on this particular research question, and an immense amount of research and testing is required to identify and understand any true gender differences in mind wandering. One way that future studies could better test this hypothesis is to categorize men and women into two groups: those with ADHD and those without. I believe that this distinction is important because Mowlem and colleagues’ found in their study that men with ADHD reported higher levels of inattention. My results concluded that there are no gender differences in mind wandering; however, I believe that a difference could be found if an ADHD diagnosis distinction is made.
References


