Investigating the relation between boredom and media multitasking

by

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Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contributions

The experiments presented here were a collaborative effort between Dr. Brandon Ralph and I, under the supervision of Dr. Daniel Smilek and Dr. James Danckert. I am the primary author of this manuscript. I was also involved in the design of the experiments as well as collecting and analyzing the data for the experiments. Dr. Brandon Ralph contributed to the design of the experiments, programmed the computerized experimental tasks and was involved in the data collection process. Dr. Daniel Smilek and Dr. James Danckert guided the entire research process, including experimental design, interpretation of the data and writing of the manuscript.

Abstract

Media multitasking entails simultaneously engaging in multiple tasks when at least one of the tasks is based in media. Despite the abundance of research devoted to understanding the antecedents of media multitasking, little research has focused directly on what might be the most common trigger of media multitasking: boredom. Across two studies, we tested the assumption that state boredom leads to media multitasking by manipulating participants' levels of boredom using video mood inductions prior to administering an attention-demanding 2-back task during which participants could media multitask by playing a task-irrelevant video. Experiment 1 also explored whether individual differences in trait boredom proneness predict the extent to which participants media multitask in the lab. We found no direct evidence for the view that state boredom leads to media multitasking. However, trait boredom proneness predicted greater amounts of media multitasking in Experiment 1. Unexpectedly, in both experiments, post-task ratings of boredom were equivalent regardless of mood induction condition, alerting us to the short-lived effects of video mood inductions and the boring nature of cognitive tasks. The implications of our findings are discussed in detail.

Acknowledgements

I would like to thank my supervisors, Dr. Daniel Smilek and Dr. James Danckert, for their guidance and enthusiasm throughout this process. I would also like to thank Dr. Brandon Ralph for contributing to the design of the experiments presented here, programming the experimental tasks and lending his valued expertise on the study of media multitasking and attention. Finally, I would like to extend my thanks to my readers, Dr. Evan Risko and Dr. James Danckert, for their time and feedback on improving my thesis.

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Introduction

In recent years, use of multimedia devices such as smartphones and laptops has become widespread. Meanwhile, concerns have grown that these readily accessible devices are intruding into our daily lives and affecting our ability to focus on a single task at a time. In line with these concerns, a 2012 study estimated that college students spend an average of 1 hour per day using Facebook, 43 minutes per day searching the internet and 22 minutes per day checking e-mails *while completing schoolwork* (Junco & Cotten 2012). Perhaps more worrisome given the dangers of distracted driving, when asked about phone use while driving, 90% of respondents in a 2015 study reported that they had texted while driving at least once within the past month (Hill et al, 2015). This common tendency to engage in media-based tasks concurrently with one or more other tasks describes the phenomenon of media multitasking.

Despite the prevalence of media multitasking, most research on the matter suggests that we are generally unable to media multitask effectively. For instance, media multitasking during lectures has been associated with poor learning outcomes (Demirbilek & Talan, 2018; Wammes et al., 2019). Moreover, media multitasking while reading appears to slow reading time and can, in some cases, have detrimental effects on reading comprehension (Bowman, Levine, Waite & Gendron, 2010; Fox, Rosen & Crawford, 2009; Lee, Lin & Robertson, 2012; Lin, Lee & Robertson, 2011). Interestingly, people appear to be aware that media multitasking hinders their performance on certain tasks, but may choose to do so nonetheless

(Ralph, Seli, Wilson & Smilek, 2020). These findings stress the importance of understanding what factors motivate people to media multitask.

Some research has approached this question by exploring the immediate needs that drive individuals to media multitask, often identifying desires to engage in routine activity, to seek enjoyment, to socialize, or to feel efficient by simultaneously engaging in multiple streams of information, as motives for media multitasking (Bardhi, Rohm & Sultan, 2010; Hwang, Kim & Jeong, 2014; Kononova & Chiang, 2015; Kononova & Yuan, 2017; Lim & Shim, 2016; Lin, 2019; Robison, 2017ab; Su & Chen, 2017; Zhang & Zhang, 2012). People may also media multitask to feel a sense of control over their consumption of information or to satisfy cognitive needs related to learning and information-seeking (Bardhi et al., 2010; Chang, 2017; Kononova & Chiang, 2015; Robison, 2017ab; Wang & Tchernev, 2012). Other research has explored the individual differences that increase one's likelihood of media multitasking. Among the most common to emerge in this line of research have been sensation seeking, impulsivity and tendencies related to poor self-control, such as poor time management and difficulty regulating one's use of media (Foehr, 2006; Jeong & Fishbein, 2007; Lim & Shim, 2016; Sanbonmatsu, Strayer, Medeiros-Ward & Watson, 2013; Yang, Xu & Zhu, 2015; Yang & Zhu, 2016; Zhang & Rau, 2016). However, within the realms of research investigating the state and trait-level predictors of media multitasking, relatively little research has focused specifically on what might be the most frequent antecedents of media multitasking: boredom.

Boredom is the aversive state that arises when one wishes to engage in a task but is unable to do so (Danckert, Mugon, Struk & Eastwood, 2018; Eastwood, Frischen, Fenske &

Smilek, 2012). Furthermore, it is theorized that boredom helps us to prioritize between multiple goals by signaling to us when our current activity is no longer satisfying, thereby motivating the search for new opportunities for engagement (Bench & Lench, 2013; Bench & Lench, 2019; Kurzban, Duckworth, Kable & Myers, 2013). Importantly, Danckert and colleagues (2018) note that, while boredom may motivate the pursuit of new goals, the boredom signal does not inform us of which activities will optimally satisfy our need for engagement or best serve our current goals. Therefore, it seems likely that those with ready access to technology would frequently turn to media-based tasks, including media multitasking, to quickly escape feelings of boredom.

Consistent with the notion that boredom leads to media multitasking, students commonly cite boredom as a trigger of media multitasking (Rosen, Carrier & Cheever, 2013; Terry, Mishra & Roseth, 2016). Moreover, a study conducted by Ralph and colleagues (2020) found that participants were more likely to media multitask while completing a low-demand, boring task relative to a more challenging high-demand task. They also found that greater amounts of media multitasking were associated with lower ratings of boredom at the end of the tasks. This was especially apparent among those completing the low-demand (boring) task. Taken together, their findings suggest that people are more likely to media multitask under conditions that foster boredom, presumably to alleviate feelings of boredom.

If in-the-moment feelings of boredom increase one's likelihood of media multitasking, those high in trait boredom proneness, who are particularly prone to experiencing frequent and intense bouts of boredom[1], should media multitask more often than individuals who are less boredom-prone. Indeed, those who report that they are often bored during leisure time (leisure boredom; Isa-Ahola & Weissinger, 1990) as well as those high in trait boredom proneness, as measured by the boredom proneness scale (Farmer & Sundberg, 1986), report frequently media multitasking in daily life (Lin, Kononova & Chiang, 2019; Ralph, Thomson, Eastwood & Smilek, 2014). Trait boredom proneness has also been associated with mobile phone use while driving (Oxtoby, Schroeter, Johnson & Kaye, 2019).

It may also be worth noting that boredom-prone individuals, like frequent media multitaskers, often score low on measures of self-control (Isacescu, Struk & Danckert, 2016; Struk, Scholer & Danckert, 2016). Low self-control among these individuals may impair their ability to sustain focus on a single task and resist potential distractions. In support of this claim, patterns of media use indicative of difficulty moderating one's use of media, such as problematic smartphone and internet use, are commonly seen among those high in leisure boredom as well as those high in trait boredom proneness (Elhai, Vasquez, Lustgarten, Levine & Hall, 2018; Lin et al., 2019; Lin, Lin & Wu, 2009; Skues, Williams, Oldmeadow & Wise, 2016; Wegmann, Ostendorf & Brand, 2018). These factors may help explain why boredom-prone individuals report higher rates of media multitasking in daily life.

The Present Studies

[1] In the Danckert lab, we asked participants (n = 2195) how frequently and intensely they experienced boredom. Frequency (r = 0.64) and intensity (r = 0.49) were found to significantly correlate with scores on the short version of the boredom proneness scale (Struk, Carriere, Cheyne & Danckert, 2017).

There is a substantial body of evidence pointing to a relation between boredom and media multitasking. However, most evidence suggesting that state boredom leads to media multitasking has come from studies relying on participants' retrospective reports of reasons for media multitasking. No research to date has experimentally investigated whether a directional relationship exists between boredom and media multitasking. Moreover, most studies investigating the association between trait boredom proneness and media multitasking have approached the problem by linking various individual difference metrics to participants' reports of media use in daily life. Whether individual differences in trait boredom proneness predict in-the-moment patterns of media multitasking remains to be explored.

This thesis presents two studies which address these gaps in the literature. To experimentally investigate whether state boredom leads to media multitasking, we manipulated participants' levels of boredom by exposing them to a previously validated boredom or interest induction video (Danckert & Merrifield, 2016; Merrifield & Danckert, 2014). Following the mood induction, we administered a 2-back task during which participants had the option to media multitask. On each trial of the 2-back, a letter appeared in the center of the screen and participants were instructed to press the spacebar on target trials, when the letter present on the screen matched the letter presented two trials back. Performance on the 2-back was evaluated in terms of the proportion of correct responses on target trials (hits) and the proportion of incorrect responses on non-target trials (false alarms). To measure rates of media multitasking during the 2-back, we employed a paradigm developed by Ralph and Seli (2020), in which participants could turn a task-irrelevant video on or off at any point during the 2-back by pressing a key. The number of trials during which the video was being played served as our measure of media multitasking. We hypothesized that participants who viewed the boring video would show higher rates of media multitasking on the 2-back relative to those who viewed the interesting video.

We also correlated levels of trait boredom proneness, as measured by the Short Boredom Proneness Scale (SBPS; Struk, Carriere, Cheyne & Danckert, 2017), with media multitasking during the 2-back to assess whether individual differences in trait boredom proneness would predict the extent to which participants media multitasked during the 2-back. We anticipated that trait boredom proneness would be associated with greater amounts of media multitasking on the 2-back.

Experiment 1

The purpose of Experiment 1 was to investigate whether state boredom leads to media multitasking and whether trait boredom predicts the extent to which participants' media multitask during a laboratory (2-back) task.

Method

Participants. 137 undergraduate students (32 male, 104 female and 1 unknown) with an age range of 16 to 35 (M_{age} = 19.49, *SD* = 2.25) were recruited from a human participant pool at the University of Waterloo and participated in exchange for 0.5 course credits. Prior to analyzing the data from this experiment, we observed the distributions of participants' hits and false alarms on the 2-back to remove participants with particularly poor performance, as very low performance on the 2-back is likely indicative of a failure to compete the task as instructed. Participants with hit rates under 10% or false alarm rates over 20% were removed from our final dataset. Our final sample consisted of 129 participants (31 male and 98 female; M_{age} =19.50, *SD* = 2.30).

Materials.

Mood inductions. To induce state boredom, participants watched a 4-minute video of men silently hanging laundry. Interest was induced by presenting participants with a 4-

minute clip taken from the British Broadcasting Company's (BBC) series *Planet Earth*, which portrayed colourful scenes of marine life accompanied by narration and music.

Trait boredom proneness. Participants' levels of trait boredom proneness were assessed by summing scores on the SBPS. The SBPS requires participants to rate their agreement with eight questions on a Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Questions include, "I find it hard to entertain myself" and "Many things I have to do are repetitive and monotonous". Scores may range from 8 to 56, with higher scores corresponding to higher levels of trait boredom proneness.

State boredom. State boredom was probed on three occasions throughout the experimental session: Prior to watching the mood induction video, immediately after the mood induction, and following completion of the experimental task. Participants indicated their level of boredom by responding to the question, "How bored do you feel right now?" on a Likert scale ranging from 1 (*not bored at all*) to 7 (*very bored*).

2-back and media multitasking. Participants completed 468 trials (18 practice trials and 450 experimental trials) of a computerized 2-back task. On each trial, participants were presented with a letter in the centre of the screen (B, F, K, H, M, Q, R, or X) for 500 ms followed by a fixation cross for 2000 ms. Participants were asked to respond by pressing the spacebar when the letter present on the screen matched the letter presented two trials previously. The 2-back contained 78 target trials and 390 non-target trials. Practice trials were removed from our final analyses.

Prior to commencing the 2-back, participants were informed that they could watch an optional video (a TED Talk by Keith Barry called “Brain Magic”) while completing the 2-back. If played, the video appeared in the upper, middle portion of the screen (Figure 1). The video could be turned on and off at the discretion of the participant by pressing the ‘t’ key. The length of the video was made to correspond to the total duration of the 2-back task, which lasted approximately 19.5 minutes. Participants received the following instructions regarding the mood induction condition:

> "While you complete this task, you will also have the opportunity to watch a video. There will be no test on the content of this video, and you are not required to watch it. However, you may watch the video while you do the 2-back, if you wish. The video will be turned off once you begin the task, but you may toggle the video on and off at your leisure, throughout the task, using the 't' key (remember t for Toggle).”

The number of trials during which the video was played served as our measure of media multitasking.

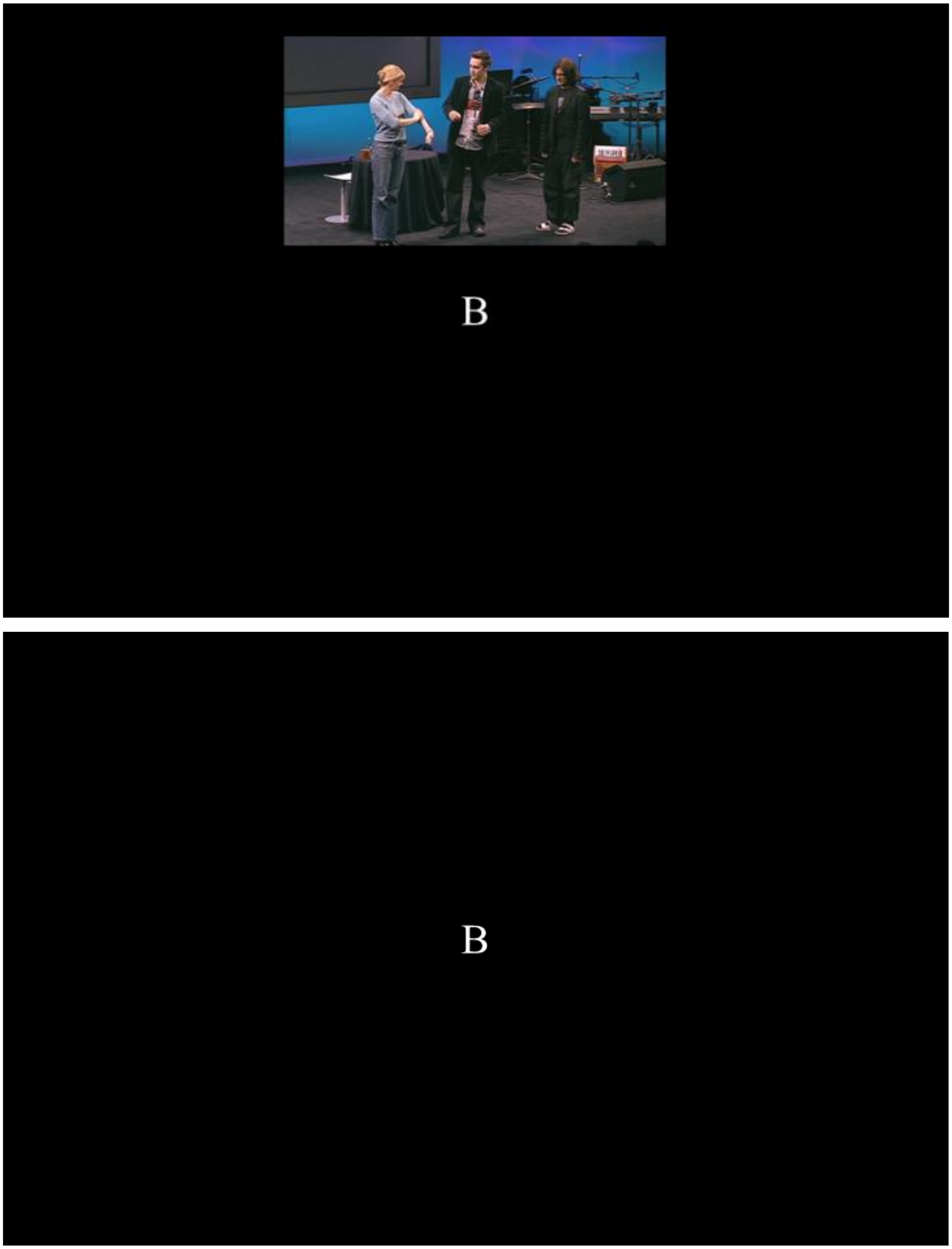

Figure 1. Depiction of how the 2-back task appeared to participants when the task-irrelevant video was turned on (top) or off (bottom).

Procedure. Participants were run in groups of one to four, depending on the number of sign-ups for a given timeslot, with their view of other participants obstructed by dividers placed between the desks. After participants provided informed consent, the experiment code was launched. All instructions for the experiment were provided on the computer screen and were accompanied by verbal instructions from a research assistant. Additionally, participants wore headphones throughout the experiment to reduce noise in the experiment room and to prevent them from hearing whether others were media multitasking with the video. At the start of the experiment, participants reported their level of boredom and were then randomly assigned to view the boredom (n = 68) or interest induction (n = 61) video. Participants then provided post-induction ratings of boredom before completing the 2-back, during which they could media multitask. Following the 2-back, participants were probed once more to report their levels of boredom. The entire experiment lasted approximately 25 minutes.

Trait boredom proneness scores were retrieved separate from the experimental session. The SBPS was included as part of a mass testing questionnaire administered to the human participant pool at the University of Waterloo. SBPS scores were pulled from the mass testing questionnaire after data collection was complete and linked to the current dataset.

Results

State boredom. Mean boredom scores for each condition are illustrated in Figure 2. To assess changes in boredom over the course of the experimental session, ratings of state boredom were submitted to a 2 (Video: boredom or interest induction) x 3 (Time: pre-induction, post-induction or post-task) mixed factorial ANOVA. Mauchly's test indicated that the assumption of sphericity had been violated ($\chi^2(2) = 14.45$, $W = 0.89$, p = .001). Therefore, results with degrees of freedom corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = 0.90$) are reported. There was a main effect of condition, $F(1, 127) = 15.20$, $p < .001$, $\eta_p^2 = .11$, a main effect of time, $F(1.80, 229.17) = 49.81$, $p < .001$, $\eta_p^2 = .28$, and a significant interaction between condition and time, $F(1.80, 229.17) = 30.55$, $p < .001$, $\eta_p^2 = .19$.

Multiple comparisons adjusted using Tukey's HSD confirmed that the mood inductions were successful in inducing their intended moods. That is, those who watched the boring video became significantly more bored ($p < .001$), while those who watched the interesting video became less bored ($p = .002$). Importantly, following the mood induction, those in the Boredom condition were significantly more bored than those in the Interest condition ($p < .001$).

We also observed changes in boredom from the start to the end of the 2-back task. Participants in the Interest condition experienced a significant increase in boredom following completion of the task ($p < .001$), whereas those in the Boredom condition did not ($p = .675$). Post-task ratings of boredom did not differ between groups ($p = .557$).

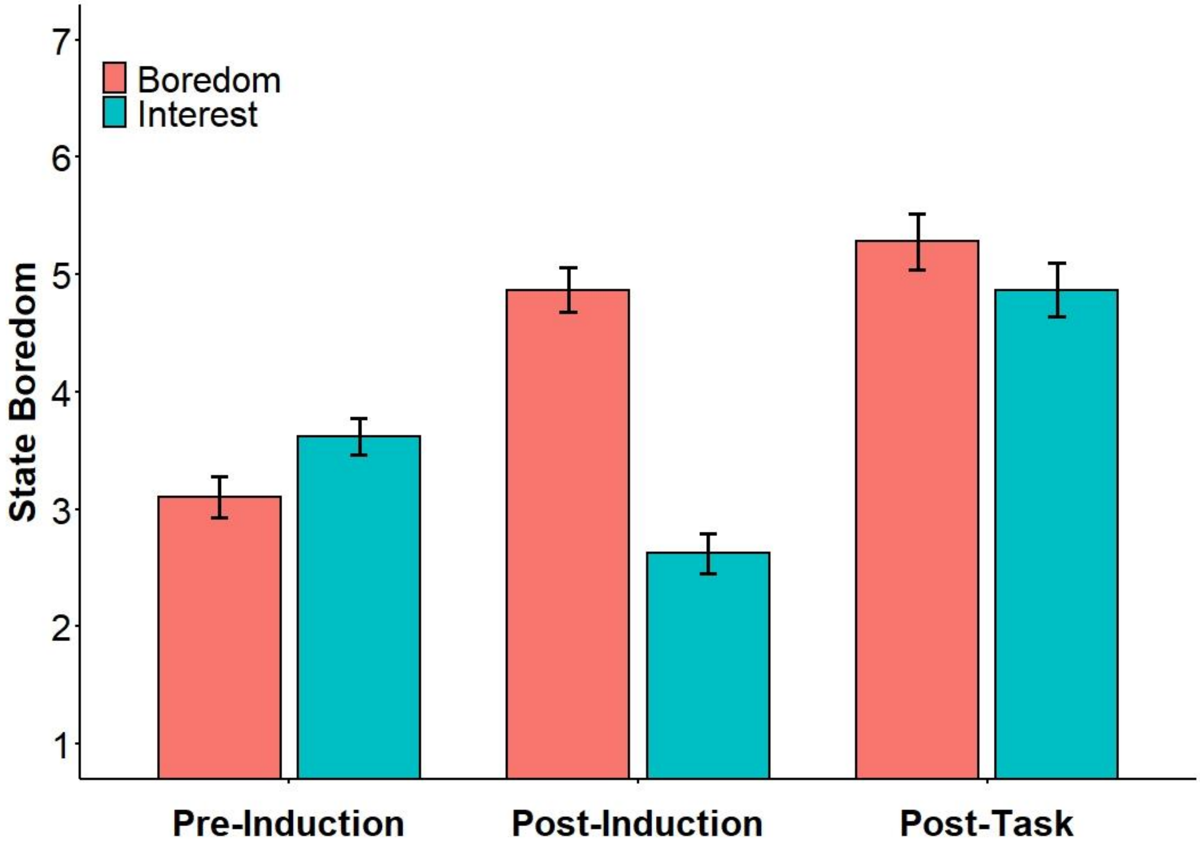

Figure 2. Bar graph showing mean ratings of state boredom before and after the mood inductions as well as following completion of the 2-back task among participants exposed to the boredom and interest inductions. Error bars represent the standard error of the mean.

Media multitasking. Due to the highly skewed nature of the media multitasking data (Figure 3), a Wilcoxon ranked-sum test was used to compare rates of media multitasking between groups. Results revealed that rates of media multitasking did not differ significantly between those who had undergone the boredom (*Mdn* = 65) and interest (*Mdn* = 117) inductions, *W* = 1935.50, *p* = .512.

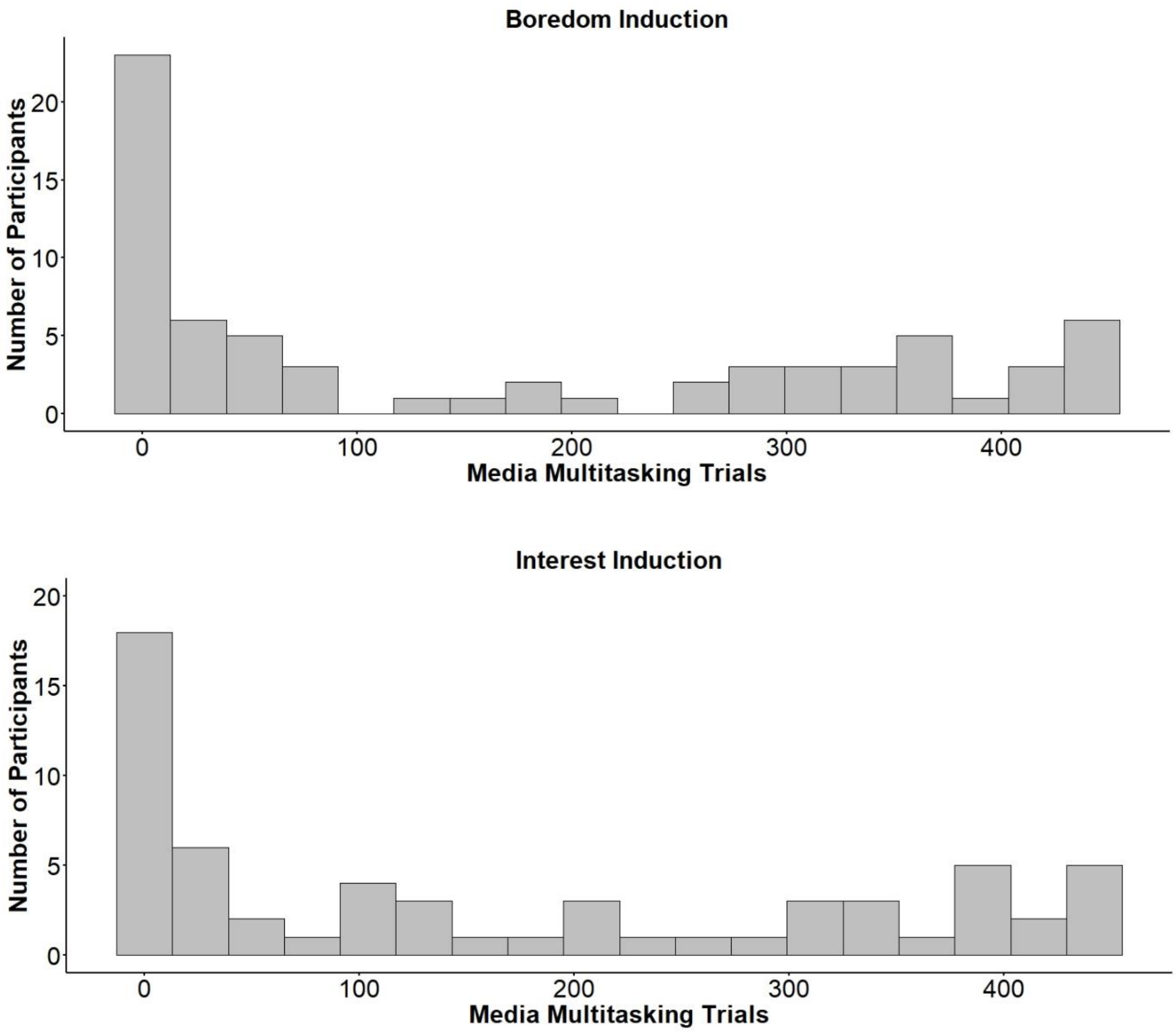

Figure 3. Histograms showing the total number of participants who media multitasked for a given number of trials. Histograms are split based on whether participants were exposed to the boredom (top) or interest (bottom) induction video.

Trait boredom and media multitasking. A Spearman's rank correlation was run to examine whether trait boredom proneness was associated with higher rates of media multitasking on the 2-back. SBPS scores were not provided by one participant and were therefore not included in the present analysis. Trait boredom proneness positively predicted the number of 2-back trials during which participants played the task-irrelevant video, $r_s(126) = .28$, $p = .001$ (Figure 4).

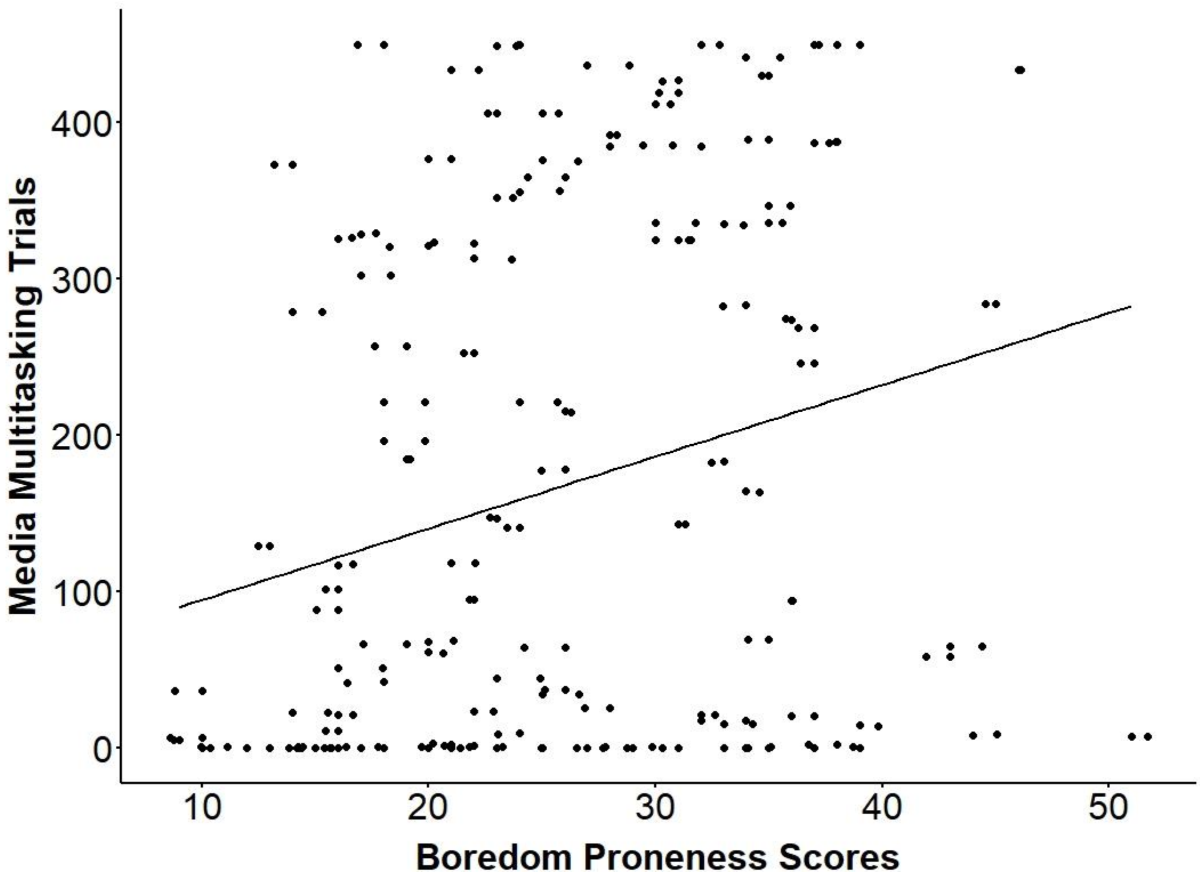

Figure 4. Scatterplot illustrating the relationship between trait boredom proneness and the number of trials spent media multitasking.

2-back performance. Performance on the 2-back does not directly relate to our main research questions. However, for the sake of completion, we report performance on the 2-back in terms of proportions of hits and false alarms. Two independent samples t-tests were conducted with mood induction condition as the independent variable and either proportion of hits or false alarms as the dependent variable. Results revealed that proportions of hits on the 2-back did not differ significantly between those in the Boredom (*M* = 0.63, *SD* = 0.20) or Interest (*M* = 0.61, *SD* = 0.24) conditions, $t(127) = 0.28$, $p = .777$, $d = 0.05$. Similarly, those in the Boredom condition (*M* = 0.08, *SD* = 0.06) showed similar false alarm rates to those in the Interest condition (*M* = 0.07, *SD* = 0.06), $t(127) = 1.39$, $p = .168$, $d = 0.24$.

Exploratory analyses. As an exploratory analysis, we investigated whether greater amounts of media multitasking during the 2-back predicted lower ratings of post-task boredom. As shown in Figure 5, the more trials participants spent with the video on, the lower their ratings of boredom at the end of the 2-back task, $r_s(126) = -.22$, $p = .011$.

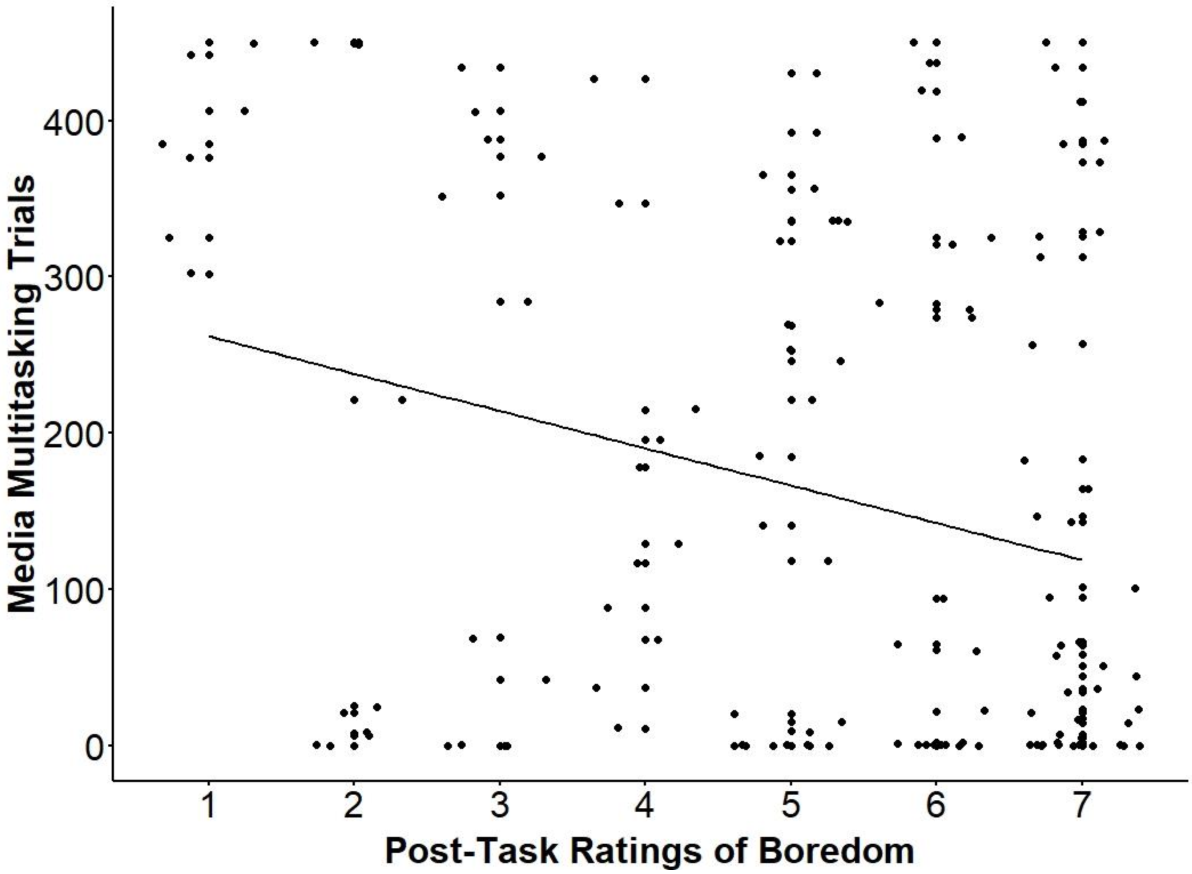

Figure 5. Scatterplot depicting the relationship between the total number of trials spent media multitasking and post-task ratings of boredom.

Additionally, our failure to find a difference in overall rates of media multitasking between those who viewed the boredom and interest mood induction videos, coupled with the finding that post-task ratings of boredom were comparable between the groups, raised the possibility that the effects of our mood inductions were short-lived. To explore the possibility that our inductions had short-lasting effects on media multitasking, we plotted media multitasking over the course of the 2-back task by summing the number of participants who had the video on for each trial of the 2-back task (Figure 6). Plotting the time course of media multitasking showed that the number of participants multitasking within the first 100 trials of the 2-back was nominally higher in the Boredom condition compared to the Interest condition. However, rates of media multitasking did not differ significantly between those in the Boredom (*Mdn* = 0.50) and Interest (*Mdn* = 2.00) conditions within the first 100 trials of the task, $W = 2068$, $p = .978$. Another interesting trend revealed by this plot was that the number of participants media multitasking per trial increased dramatically with time on task.

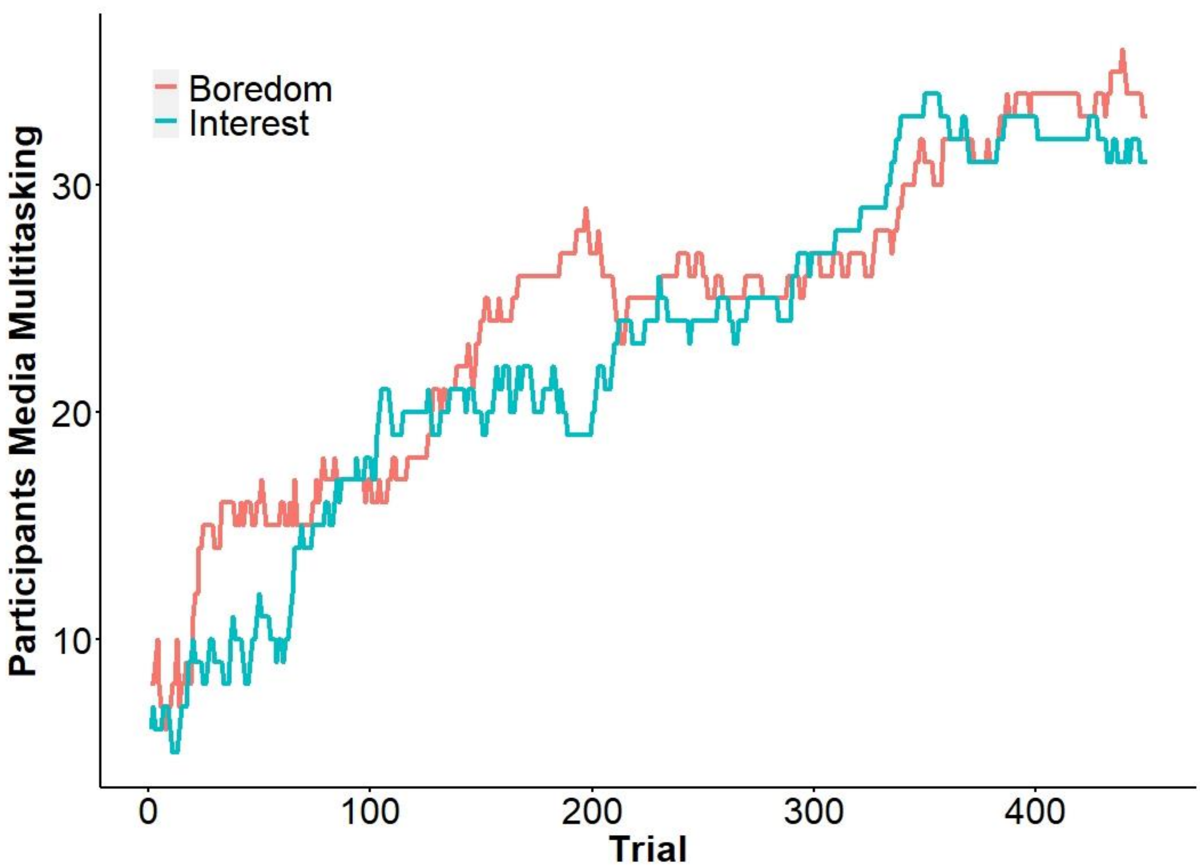

Figure 6. Line graph showing the total number of participants media multitasking for each trial of the 2-back.

Discussion

In our initial experiment, we examined whether state and trait boredom lead to media multitasking during an attention-demanding laboratory task. Manipulating participants' levels of boredom had no effect on rates of media multitasking. Therefore, we did not find direct evidence to support the notion that state boredom leads to media multitasking. However, consistent with our second hypothesis, trait boredom proneness predicted greater amounts of media multitasking on the 2-back. Interestingly, and congruous with past findings (Ralph et al., 2020), we also found that greater amounts of media multitasking during the 2-back were associated with lower ratings of post-task boredom.

An unexpected outcome of this experiment was that, although our mood inductions were initially successful in inducing their intended moods, post-task ratings of boredom were equivalent between those who had undergone the boredom and interest inductions. This finding raises the possibility that the effects of our mood inductions were simply too short-lived to lead to any significant differences in media multitasking between groups. One factor that may have shortened the duration of their effects could be the boring nature of the 2-back task itself. Recall that those in the interest condition experienced a significant increase in boredom from the start to the end of the 2-back. Perhaps the reason groups converged in their ratings of boredom following completion of the task was that the 2-back was sufficiently boring to overpower the effect of the interest induction.

Another interesting finding from our first experiment was that a nominally greater number of participants in the Boredom condition relative to the Interest condition were media multitasking within the first 100 trials of the 2-back. While rates of media multitasking did not differ significantly between groups during this initial period, this finding motivated us to explore further whether inducing state boredom might have a short-lasting effect on media multitasking.

Experiment 2

In our second experiment, we employed a similar paradigm to the one used in Experiment 1 to further investigate whether state boredom leads to media multitasking. To account for the possibility that our ability detect an effect of inducing boredom on media multitasking in Experiment 1 was hindered by the short-lived effects of our mood inductions and the boring nature of the 2-back task, and to maximize our chances of detecting an effect in the present study, the length of the 2-back was shortened to only 108 trials. We predicted that inducing state boredom would lead to short-term increases in media multitasking. We were also interested in replicating the associations found in Experiment 1 between trait boredom and media multitasking and media multitasking and post-task boredom.

Method

Participants. 162 participants were recruited through Amazon Mechanical Turk and participated in exchange for $2.00 paid to their Mechanical Turk account. In order to take part in our study, participants were required to have a hit rate of at least 97% and a minimum approval rate of 10 000. 17 participants, who failed to meet our compliance check (see below), were removed prior to analysis of the data. Additionally, we inspected the distributions of participants' hits and false alarms to remove participants with particularly poor performance on the 2-back, as very low scores on the 2-back are likely indicative of a failure to complete the task as instructed. Participants with false alarm rates over 40% were removed from our final dataset. Our final sample consisted of 135 participants.

Materials and procedure. The materials and procedure in this experiment were nearly identical those in Experiment 1, with some exceptions. After viewing the boredom (*n* = 66) or interest (*n* = 69) induction video, participants were given the option to media multitask while completing a 2-back task that lasted only 108 trials (18 practice trials and 90 experimental trials), or 4.5 minutes. Due to an error in the experiment code, target frequency during the experimental trials varied between participants, ranging from 12 to 17 targets per participant. Importantly, target frequency did not differ significantly between those in the Boredom (*M* = 15.42, *SD* = 1.12) and Interest conditions (*M* = 15.38, *SD* = 0.99), $t(133) = 0.26$, $p = .795$. Finally, following completion of the 2-back, participants responded to a post-task compliance check which asked whether they had engaged in activities unrelated to the experiment while participating in our study. Participants received the following question and response options:

> "While completing this study, were you engaged in any media-related activities outside of the contents of the experiment (e.g. attending to content in another browser, listening to music or using a smartphone/tablet while completing the study)?
>
> Yes.
>
> No, I didn't engage in any activities outside of the contents of this study.
>
> No, but I was engaged in other, media-unrelated activities while completing this study."

Those who reported having engaged in activities unrelated to the experiment were removed from our final dataset. The entire experiment lasted approximately 7 minutes.

Results

State boredom. Mean ratings of state boredom for those in the Boredom and Interest conditions are shown in Figure 7. To track changes in boredom throughout the experimental session, ratings of state boredom were submitted to a 2 (Video: boredom or interest induction) x 3 (Time: pre-induction, post-induction or post-task) mixed factorial ANOVA. Results revealed a main effect of video, $F(1, 133) = 17.55$, $p < .001$, $\eta_p^2 = .12$, a main effect of time, $F(2, 266) = 42.72$, $p < .001$, $\eta_p^2 = .24$, and an interaction between time and video, $F(2, 266) = 56.70$, $p < .001$, $\eta_p^2 = .30$.

Multiple comparisons adjusted using Tukey’s HSD confirmed that our mood inductions were successful. Boredom levels increased significantly following the boredom induction, leaving those who viewed the boring video significantly more bored than those who watched the interesting video (*p*s < .001).

Multiple comparisons also showed that, relative to pre-task ratings of boredom, those in the Interest condition became significantly more bored following completion of the 2-back ($p < .001$), while those in the Boredom condition became less bored ($p < .001$). Post-task ratings of boredom were equivalent between those in the Boredom and Interest conditions ($p = .987$).

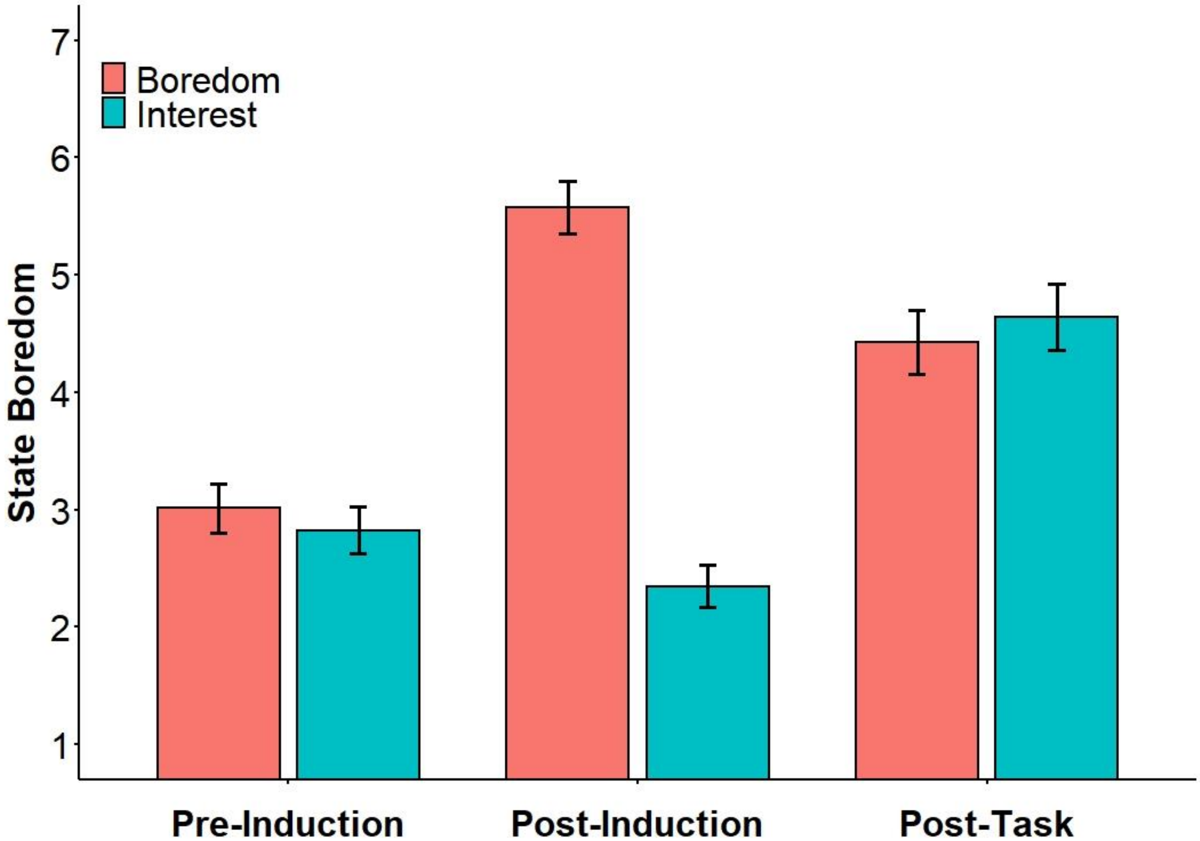

Figure 7. Bar graphs illustrating mean ratings of state boredom among those who viewed the boredom or interest induction video. Ratings of boredom were taken before and after the mood induction as well as following completion of the 2-back task. Error bars represent the standard error of the mean.

Media multitasking. Given the skewed nature of the media multitasking data (Figure 7), a Wilcoxon ranked-sum test was used to assess whether media multitasking differed based on mood induction condition. There was no significant difference in rates of media multitasking between conditions (*Mdns* = 0), $W = 2456$, $p = .254$. However, plotting the time course of media multitasking during the 2-back revealed a similar pattern to that observed within the first 100 trials of the 2-back in Experiment 1 (Figure 8). Specifically, the number of participants media multitasking during the 90 experimental trials of the 2-back was nominally greater in the Boredom condition relative to the Interest condition.

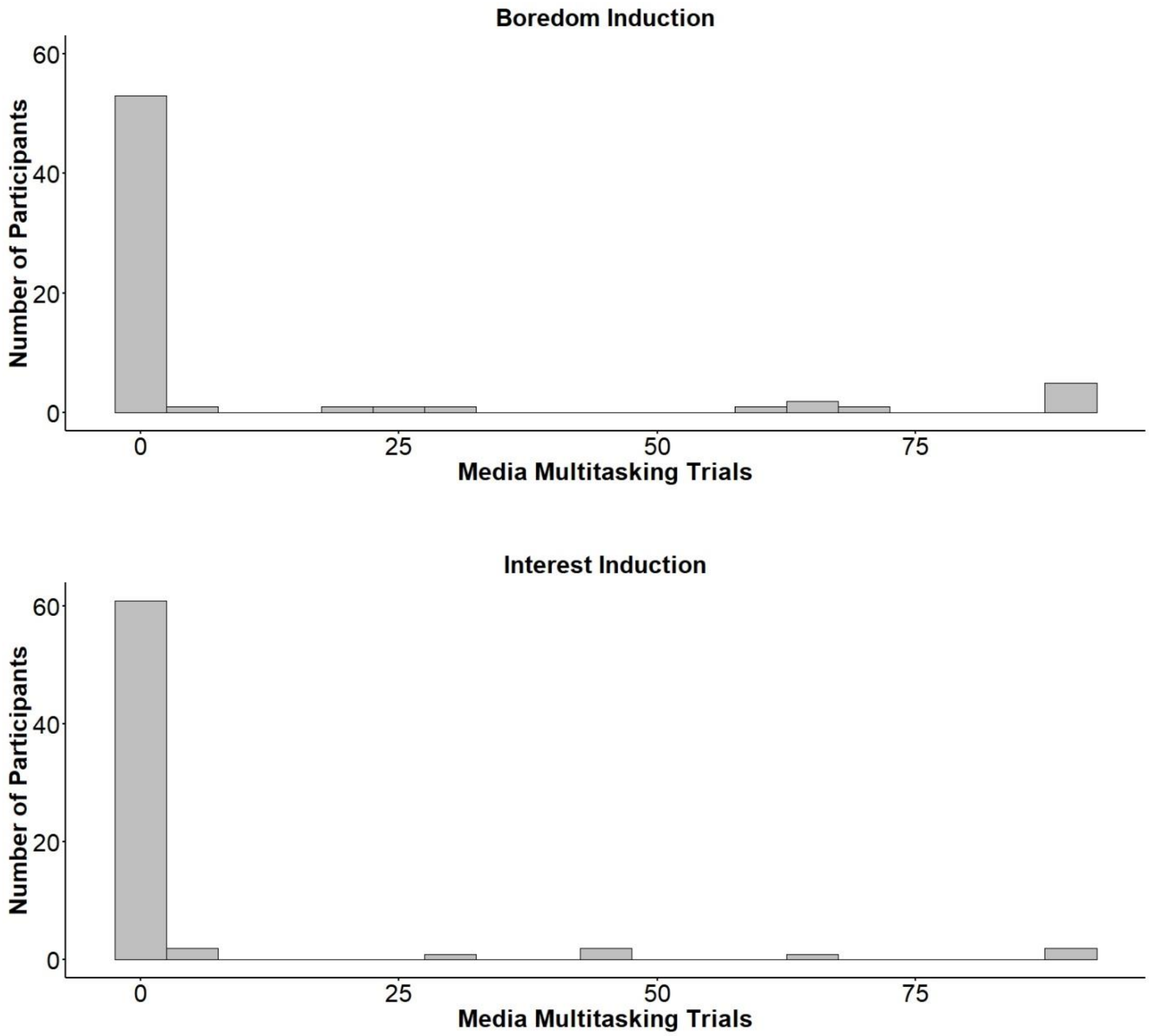

Figure 8. Histograms showing the total number of participants who media multitasked for a given number of trials, based on whether they viewed the boredom (top) or interest (bottom) induction videos.

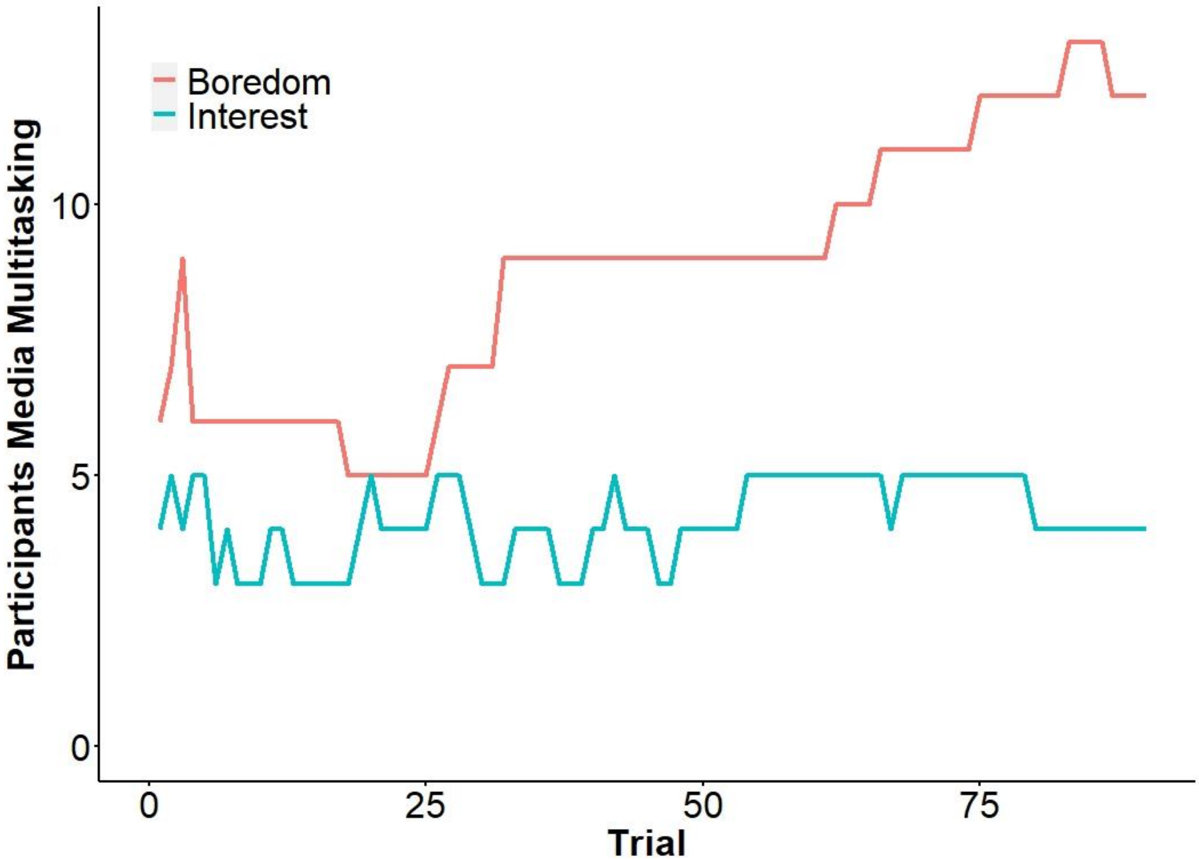

Figure 9. Line graph depicting the total number of participants in each mood induction condition who media multitasked for each trial of the 2-back.

Correlational analyses. Because rates of media multitasking were extremely low, correlational analyses evaluating the relationships between trait boredom and media multitasking and between media multitasking and post-task ratings of boredom were not conducted. We felt that performing these analyses using too few observations of media multitasking could provide inaccurate representations of these relationships.

2-back performance. While performance on the 2-back does not relate to our primary research questions, 2-back performance is detailed here for the sake of completion.

Two independent samples t-tests were conducted with mood induction condition as the independent variable and either proportion of hits or false alarms as the dependent variable. Proportions of hits did not differ significantly between those in the Boredom (*M* = 0.75, *SD* = 0.24) or Interest (*M* = 0.70, *SD* = 0.29) conditions, $t(133) = 1.03$, $p = .305$, $d = 0.18$. Similarly, proportions of false alarms were comparable between the Boredom (*M* = 0.09, *SD* = 0.08) and Interest (*M* = 0.09, *SD* = 0.08) groups, $t(133) = -0.15$, $p = .883$, $d = -0.03$.

Discussion

In Experiment 2, we sought to investigate whether inducing state boredom leads to short-term increases in media multitasking. We were also interested in whether trait boredom would predict media multitasking on the 2-back and whether media multitasking would be associated with post-task ratings of boredom, as was the case in Experiment 1. Although there appeared to be a greater number of participants media multitasking in the Boredom relative to the Interest condition, we found no differences in rates of media multitasking between those who underwent the boredom and interest inductions. Therefore, our hypothesis that inducing state boredom would lead to short term increases in media multitasking was not confirmed. Moreover, low rates of media multitasking prevented us from conducting correlational analyses assessing the relationships between trait boredom and media multitasking and media multitasking and post-task boredom.

Low rates of media multitasking may be explained by the sample collected in the present study. Whereas our sample in Experiment 1 consisted of undergraduate students participating in exchange for course credit, participants in the present experiment were recruited through Amazon Mechanical Turk and took part in our study in exchange for monetary reward. As such, these participants may have been more motivated to perform well on the 2-back and thus chose not to media multitask. Another possibility is that participants in the present study avoided media multitasking because they found the 2-back task more challenging than participants in the previous experiment. Consistent with this interpretation, previous research has shown that individuals will modulate their media multitasking based on task demands (Ralph et al., 2020).

Low rates of media multitasking may have contributed to our inability detect differences in media multitasking between groups. However, equivalent levels of post-task boredom between those in the Boredom and Interest conditions indicate that our failure to detect group differences more likely stems from the short-lasting effects of our mood inductions, which did not persist for the duration of our 4.5-minute task.

General Discussion

Across two studies, we manipulated participants' levels of state boredom to experimentally investigate whether state boredom leads to media multitasking. We also explored whether individual differences in trait boredom proneness would predict greater amounts of media multitasking during attention-demanding tasks. In both studies, manipulating participants' levels of state boredom did not lead to differences in rates of media multitasking between groups. Therefore, we found no direct evidence to support the notion that state boredom leads to media multitasking. However, Experiment 1 revealed that trait boredom proneness was positively associated with media multitasking, providing evidence for the view that trait boredom leads to media multitasking.

Previous research has shown that boredom-prone individuals often have difficulty regulating their media use (e.g. Elhai et al., 2018; Skues et al., 2016; Wegmann et al., 2018) and media multitask frequently in daily life (Ralph et al., 2014). Our finding that trait boredom proneness predicted high rates of media multitasking on the 2-back strengthens evidence for a link between trait boredom proneness and media multitasking by demonstrating that individual differences in boredom proneness can predict in-the-moment patterns of media multitasking.

That rates of media multitasking did not vary based on whether participants underwent a boredom or interest induction is surprising, given the amount of research pointing to state boredom as an antecedent of media multitasking (Ralph et al., 2020; Rosen et al., 2013; Terry et al., 2016). Nonetheless, evidence from both experiments lead us to believe that a likely explanation for our findings is that the effects of our video mood inductions were too short-lived to lead to any significant group differences in media multitasking. Indeed, while our videos were initially successful at inducing their intended moods, their effects did not last the duration of the 2-back, as indicated by equivalent ratings of post-task boredom between those in the Boredom and Interest conditions. This finding was particularly striking in Experiment 2, in which the 2-back task was shortened to last only 108 trials.

The short-lived effects of our mood inductions should be disconcerting for at least two reasons. First, mood inductions similar to those used in the present experiments are frequently employed in experimental psychology to study the effects of various moods on cognition and behaviour (Ferrer, Grenen & Taber, 2015). However, results from Experiment 2 warn against the use of such inductions, which may not even last the duration of a 4.5-minute task. At the very least, researchers employing mood inductions of this kind should consider probing the induced moods throughout their experiments to ensure that the inductions have exerted their intended effects. A second concern comes from findings suggesting that the short-lived effects of our inductions may have been due, in part, to the boring nature of the 2-back task. While it is no surprise that many cognitive tasks employed in psychological research tend to be monotonous and lead to feelings of boredom (e.g. Hunter & Eastwood, 2018; Scerbo, 1998), our results highlight the potential of task-induced boredom to become a confound in studies in which it is not accounted for.

Despite finding no effect of our inductions on media multitasking, observations of changes in state boredom and media multitasking with time on task in Experiment 1 suggest a strong association between state boredom and media multitasking. In our first study, participants in the interest condition experienced a significant increase in boredom from the start to the end of the 2-back task. Additionally, the number of participants media multitasking grew with each passing trial of the 2-back. These increases in state boredom, accompanied by increases in media multitasking over the course of the 2-back, suggest that, as participants became more bored with time on task, they became more motivated to media multitask to escape boredom. In support of this explanation, greater amounts of media multitasking during the 2-back were associated with lower levels of post-task boredom. One shortcoming of this explanation, however, is that it does not easily account for increases in media multitasking among those in the Boredom condition, who did not experience a significant increase in boredom following completion of the 2-back. It may be that changes in media multitasking for these participants were in fact accompanied by increases in boredom, but that ceiling effects precluded our ability to detect these changes. An alternative yet complimentary explanation comes from the finding that participants in the Boredom condition experienced a decrease in boredom following completion of the 108-trial 2-back task in Experiment 2. Perhaps the novelty of commencing a new task led to a slight decrease in boredom during the initial stages of the 2-back, but levels of boredom rose again as participants became bored with the task. This explanation is of course highly speculative and cannot be confirmed since we did not track levels of state boredom throughout the 2-back. It may, however, inform future methods of investigating whether a directional relationship exists between boredom and media multitasking.

Future research attempting to determine whether state boredom leads to media multitasking would benefit from tracking both boredom and media multitasking over the course of a laboratory task to examine whether changes in state boredom predict subsequent changes in media multitasking. Based on findings from the present work, using simple tasks that encourage high rates of media multitasking as well as boredom scales with wide ranges that help prevent ceiling effects would facilitate the detection of an effect if one exists.

To conclude, while manipulating boredom did not influence participants' levels of media multitasking in the present studies, exploratory findings from our research imply that state boredom leads to media multitasking. We also demonstrated that trait boredom predicts higher levels of media multitasking during attention-demanding tasks. Finally, while our mood inductions did not enable us to determine whether a directional relationship exists between state boredom and media multitasking, their use in our investigations led to perhaps our most important findings, which warn researchers of the short-lived effects of video mood inductions and the potential dangers of employing common but monotonous laboratory tasks when boredom is not considered.

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