Does Short-Form Video Content Impair Cognitive Performance? Investigating Exposure Effects

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Abstract

Short-form videos (SFVs), such as TikTok and Instagram Reels, have become increasingly prominent in people's lives, raising questions about their impact on cognition and behaviour. For university students, the role of SFVs becomes of interest in the context of academic procrastination, a behavioural pattern where tasks are being delayed and other, often less relevant activities are prioritised. Students have reported difficulties with reengaging with the original academic task following study breaks involving social media use. SFVs have been shown to affect cognitive processes such as memory and attention, while increased screen time has been associated with decreases in inhibitory control. This study investigates the impact of different types of media exposure on the cognitive process of inhibitory control using the Stroop Colour and Word Test (SCWT) on a sample of university students (n = 30). Participants performed the SCWT twice, before and after a ten-minute exposure to either SFVs, a long-form documentary, or ten minutes of reading a short excerpt of a text. The Stroop effect from the first round was compared to the post-exposure round. An ANOVA revealed no significant effect of the exposure condition on the Stroop effect in the post-test. However, when including the moderator variable of usual procrastination behaviour measured with the Academic Procrastination Scale (APS), the difference in the SCWT between participants in the reading condition and those in the short- or long-form video condition was statistically significant. Thereby, participants from the reading condition performed better. The model also demonstrated a better performance from the reading condition compared to the SFV condition when including the moderator of participants' average screen times. Additionally, a significant difference was found in the subjective experience of participants for the second round of the SCWT, compared to the first: participants from the SFV condition evaluated the second time performing the SCWT as more difficult. For the other two conditions, this effect could not be observed. This aligns with student reports of greater difficulties reengaging after an interruption with SFVs, although this study was unable to demonstrate their effect on inhibitory control using the SCWT.

Keywords: short-form videos, academic procrastination, inhibitory control, Stroop effect, task reengagement, screen time

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Nowadays, most of the world's population owns a smartphone (GSMA, 2024), and the social media platforms Instagram and TikTok combined had around 3.5 billion active users in 2024 (Statista, 2024). Platforms such as Facebook and Instagram are not only a means for people to stay connected to their friends online but also facilitate users' access to information from across the globe (Rhee et al., 2020). Although social media serves as a means to connect people nowadays, especially after TikTok's introduction, its predominant feature is offering short-form video content (Chiossi et al., 2023). The consumption of short-form videos (SFVs) has become essential in people's entertainment and relaxation (Xie et al., 2023).

The algorithms that determine what content users are exposed to stimulate users to remain on these apps for longer than they initially planned by providing videos that align with their interests or by building suspense (Liang, 2023). An extreme form of such consumption is called mindless scrolling, a phenomenon which is distressing to consumers because of the involuntary and unexpected durations of time they spend on social media platforms (Lee, 2025; Sinha et al., 2023). The average screen time of consumers has increased over the years, with its consequences on cognitive processes of executive functioning, such as inhibition, becoming an important concern of current research (Alah et al., 2024; Toh et al., 2021). Despite growing apprehensions around social media consumption, SFVs offer users entertainment and quick and easy distractions (Chiossi et al., 2023). Undergraduates, as the main consumer group, are using SFVs as a common way to procrastinate (Linlin et al., 2023; Yeh et al., 2017).

Procrastination is a behavioural pattern involving the voluntary postponement of tasks, although expecting it to have negative consequences (Steel, 2007). Procrastination can appear in a variety of contexts such as academia, sports or everyday life (Zhou et al., 2021). In the academic context, procrastination refers to the delay in working on academic tasks, which can negatively impact student performance (Svartdal & Løcke, 2022). The mechanism behind this association in connection with the impact of SFV consumption has not been fully explored. Studies have indicated that delaying academic tasks and decreased academic engagement are the main reasons why academic performance decreases with increased procrastination behaviour (Kim & Seo, 2015; Li et al., 2024; Xie et al., 2023). According to student reports, SFVs make reengaging with the task after the break more difficult. This may be because these videos can affect cognitive processes, which in turn may result in fallbacks in work (Lee, 2025). It is unclear what cognitive processes are most affected by SFV exposure, and which might cause impaired reengagement. Possible effects might be the direct impact on visual short-term

memory (Zhen, 2021) or difficulties with retaining intentions (Chiossi et al., 2023). Inhibitory control might be another of those cognitive processes affected. This executive function, which is necessary to control impulsive behaviours and competing stimuli, has been shown to be negatively impacted by an increase in screen time in developing children (Chen, 2021).

Thus, this study aims to investigate the direct impact SFVs have on inhibitory control by comparing them to other activities that could pose as procrastination activities to investigate whether it is one of the cognitive processes that complicates reengaging with a task. Insights into this process in university students could be beneficial for communication around academic procrastination. Moreover, it could be of value when designing interventions for students, as they appear to be the primary consumer group of SFVs (Linlin et al., 2023) and exhibit a high prevalence of procrastination behaviour (O'Brien, 2002; Özer et al., 2009).

Theoretical Framework

Academic Procrastination

Academic procrastination refers to the behaviour of delaying work on academic tasks, which can harm students' performance on assignments and exams (Svartdal & Løcke, 2022). This problem is prevalent in at least half of university students (Özer et al., 2009), with some estimations including up to 95% of college students (O'Brien, 2002). Procrastination behaviour has been found to negatively affect academic performance (Kim & Seo, 2015). Moreover, it has been associated with higher states of stress and academic anxiety, whereby stress can be seen as both a risk factor for and a consequence of academic procrastination (Li et al., 2024). Due to higher levels of perceived stress, students delay working on and completing tasks (Liu & Li, 2024). Dedicating time to non-academic tasks reduces academic engagement and increases levels of anxiety (Li et al., 2024). Academic engagement is diminished through extensive procrastination, meaning students are less engaged in learning, fail to attend classes or delay the completion of assignments, which negatively influences academic performance (Li et al., 2024). Tendencies of students to procrastinate can be measured using the Academic Procrastination Scale (APS; McClosky, 2011). A common procrastinatory behaviour of students is the consumption of social media and short-form videos (Fentaw et al., 2022).

Short-Form Video Content

These short-form videos (SFVs) that students procrastinate with are forms of media with a duration that typically ranges between a few seconds and a few minutes, featuring concise content that follows clear themes (Li et al., 2024). Other than YouTube videos, which do not have a time limit and sometimes last up to two hours, platforms such as TikTok limit their users and content creators to videos of up to five minutes (Linlin et al., 2023; Yilmaz et al., 2022).

Due to these time constraints, SFVs are often heavily edited, consisting of short segments that focus on delivering specific information by combining auditory and visual information through sound, text, and images (Linlin et al., 2023; Liu & Li, 2024). Although all videos need to be shorter than five minutes, content that is on the longer side of this spectrum does not receive the same attention from consumers, and around 95% of the videos on TikTok are shorter than 15 seconds (Linlin et al., 2023; Shutsko, 2020). The most popular content revolves around funny videos, dancing, fitness, home improvement, beauty, fashion, cooking, live hacks, and animals, but can also be very specific to niche interests (Izea, 2024).

Consuming this video content has become essential for people's entertainment and is a way to relax (Liang, 2023). The algorithms behind social media apps provide SFVs that align with the consumers' interests, which keeps users on the apps for longer than they initially planned, often causing distress to consumers (Lee, 2025). Typically, users spend around two and a half hours on social media platforms daily (Kemp, 2025). The videos provide users with quick entertainment and satisfaction due to being instantly gratifying (Chiossi et al., 2023).

This instant gratification comes from consuming content that is aligned with the consumers' interests (David & Roberts, 2024). Research shows that this activates the areas in the brain associated with pleasure and releases dopamine (Akgun & Mirzajee, 2024). Higher levels of dopamine can lead to craving more dopamine-inducing activities, which intensifies the behaviour (Weinstein & Lejoyeux, 2015).

Moreover, people use social media platforms to foster connections with people (Linlin et al., 2023). SFVs are such a prominent part of students' lives that they fear missing out on social connections or trends as well as on important information if they do not frequently engage with the platforms, which further stimulates exposure (Gupta & Sharma, 2021).

Behavioural Model of Procrastination and Short-Form Video Consumption

Apart from the instant gratification effect and the fear of missing out on social connections, SFV consumption can be contextualised with the three-term contingency model or the ABC model of procrastination. This model may be used to explain how behavioural patterns develop and why, especially problematic procrastination behaviours are maintained (Svartdal & Løcke, 2022). It encompasses the antecedents of a behavioural pattern, the behaviour itself, and the consequences that follow (Svartdal & Løcke, 2022). Antecedents for the behaviour of procrastinating might include situational distractions such as notifications by phones (Lee, 2025), task aversiveness because an assignment is deemed too difficult (Svartdal & Løcke, 2022) or lack of energy (Xie et al., 2023). This leads to the behaviour of delaying working on tasks by consuming short-form videos on social media platforms (Li et al., 2024).

Svartdal and Løcke (2022) suggest that the consequences for these behaviours can be seen as a double-edged sword since they are twofold. Firstly, by removing the aversive stimulus of working on a demanding task, the general procrastination behaviour is strengthened through a process of negative reinforcement. Secondly, the alternative behaviour of engaging in distractions can lead to positive events such as spending time with friends, in person or online, which positively reinforces procrastination as well (Svartdal & Løcke, 2022). There is the feeling of being rewarded with immediate satisfaction and being entertained (Yeh et al., 2017). These quick rewards are preferred over tasks with more distant rewards, such as the completion of an academic task (Steel, 2007). Moreover, the extensive consumption of SFVs can lead to a carry-over effect on academic behaviours such as an orientation towards tasks that are quickly rewarding and focusing less on academic achievements, which require more effort in the long term (Svartdal & Løcke, 2022). This might be seen as an addition to the double-edged sword because short-form media might lead people to engage less with tasks that follow long-term goals, such as assignments with long deadlines (Svartdal & Løcke, 2022), as well as affect cognitive processes such as memory, which might impede the recalling of information (Chiossi et al., 2023). This could, in turn, increase task aversiveness because a task is deemed as too difficult, which leads to further procrastination behaviour (Svartdal & Løcke, 2022).

Depletion of Cognitive Resources

Apart from the effects that SFV consumption can have on students' academic behaviour, it may also affect cognitive processes that lead to further task aversiveness and procrastination behaviour. Students have reported that procrastinating, initiated by watching SFVs, harms their attention spans (Lee, 2025), but these findings rely solely on self-reports. Extensive SFV consumption has been shown to cause difficulties in maintaining attention and attentional deficits (Chen et al., 2022), similarly to the studied effects on working memory (Chiossi et al., 2023). This suggests that SFVs deplete or weaken certain cognitive resources, leading to negative effects on concentration (Wang et al., 2025). One possible explanation for this could be the information overload from short-form videos since they are very dense in information and try to fit the most content into the shortest amount of time (Chung et al., 2023). The rapid switch in contexts demands more attentional resources and prioritises entertainment factors as well as surface-level information over deep processing (Levey, 2025). This may lead to fatigue and a decrease in performance on a subsequent task (Sultan & Fatima, 2025). The viewer takes on a passive role in their consumption in comparison to reading, which demands more active cognitive processing (Rayner & Reichle, 2010).

Inhibitory Control

A cognitive resource that might be worth investigating in the context of SFV consumption is inhibitory control. This executive function is defined as the ability to suppress dominant or unimportant thoughts and actions, allowing individuals to control competing stimuli and focus on more important ones in order to respond more appropriately (Chen, 2021; Dvorak, 2024). Difficulties with or failures to inhibit responses can be connected to learning difficulties and behavioural problems (Munakata et al., 2011). Moreover, inhibitory control and other attention processes have been directly associated with academic performance as they control the prioritising and processing of information (Dvorak, 2024; Privitera et al., 2022). Although inhibitory control is age-dependent and develops over childhood, its association with academic achievement does not vary across ages (Durston et al., 2002; Privitera et al., 2022). Before being fully developed, inhibitory control can be negatively impacted by a variety of factors, such as a high screen time (Chen, 2021). More specifically, prolonged social media use is a factor that can negatively influence inhibitory control and other processes of executive functioning due to the amount of content and information online, which can be overwhelming (Golding et al., 2025).

Inhibitory control can be assessed with the Stroop Colour and Word Test (SCWT; Scarpina & Tagini, 2017). In this test, participants need to suppress an automatic response and instead complete a more controlled process, overriding dominant and irrelevant responses and exhibiting active inhibition (Heidlmayr et al., 2013). A higher Stroop effect is thereby indicative of lower inhibitory control (Heidlmayr et al., 2013). Since inhibitory control is a cognitive function that declines with age, the Stroop effect is greater in older adults than it is in younger ones (Munakata et al., 2011). Moreover, due to this executive function not being stable once maturity has been reached, it may be influenced by situational factors and might be depleted (West & Alain, 2000).

Current Study

The literature suggests that SFV content has an impact on a variety of consumers' cognitive processes, such as memory and long-term attentional deficits (Chen et al., 2022; Chiossi et al., 2023; Zhen, 2021). However, the direct short-term influences on cognitive processes remain relatively unknown. This could be of interest because university students have a high prevalence of procrastination behaviour (O'Brien, 2002; Özer et al., 2009), which can be connected to them being a strong consumer group of SFVs (Linlin et al., 2023). In developing children, a high screen time has been shown to negatively affect the cognitive function of inhibitory control that is also of importance for students' academic performance, as it

determines their ability to remain focused on the material and not get distracted by other stimuli (Chen, 2021; Privitera et al., 2022). If it is depleted or affected by situational factors, students may have difficulties maintaining attention and reengaging after a break because they cannot control impeding stimuli. Social media, with its overwhelming amount of information to process, can cause decreases in inhibitory control (Golding et al., 2025). This effect might be even more extreme for SFVs because of their high information density (Chung et al., 2023). Therefore, the research question for this current study is: *To what extent does exposure to short-form video content influence participants' inhibitory control compared to other forms of task interruptions?* The research question leads to the following hypotheses:

H1: *Participants exposed to short-form videos will show a greater decline in inhibitory control compared to those who are exposed to a longer video documentary.*

This is expected because in a similar study, participants exposed to SFVs performed worse on a memory task compared to the other forms of exposure, among others, long-form videos (Chiossi et al., 2023). This might be due to the rapid switch in contexts observable in SFVs and the density of information (Chung et al., 2023). This demands more attentional resources compared to watching a longer video with fewer changes, leading to a higher depletion of the cognitive process of inhibitory control (Levey, 2025). Since memory and attentional processes are closely related systems of cognitive functioning (Angelopoulou & Drigas, 2021), a similar effect is expected.

H2: *Participants exposed to short-form videos will show a greater decline in inhibitory control compared to those who read a book excerpt.*

When reading, the reader needs to take an active role and process information more in depth (Rayner & Reichle, 2010), leading to a possible decrease in cognitive capacities. Similarly to H1, however, SFVs demand more attentional resources compared to reading a book (Levey, 2025), leading to a difference in the two conditions, with SFVs expected to have a stronger negative effect.

H3: *Academic procrastination" serves as a moderator of the relationship between exposure and inhibitory control.*

Academic procrastination may serve as a moderator in this relationship because of the model proposed by Svartdal and Løcke (2022). Students who show a greater tendency to procrastinate might be more vulnerable to this behaviour being reinforced through more enjoyable activities. Therefore, participants with stronger procrastination habits, and therefore a higher score on the Academic Procrastination Scale (McClosky, 2011), might show a greater

decline in inhibitory control compared to participants who are not as susceptible to the reinforcements.

H4: *Screen time serves as a moderator of the relationship between exposure and inhibitory control.*

This is expected because the level of screen time for children has been associated with a decrease in inhibitory control (Toh et al., 2021). Moreover, short-form media has already been shown to have long-term effects on consumers' cognitive processes (Chen et al., 2022). Therefore, participants with higher levels of screen time might be more susceptible to the exposure of short-form videos.

To investigate the effects of various exposures on inhibitory control, an experimental study with university students was designed. A between-subjects design was used with three conditions; participants in each condition were exposed to different forms of media, namely short-form videos, a long-form documentary and a book excerpt to read. Inhibitory control, as the dependent variable, was measured pre- and post-exposure.

Method

Participants

For the recruitment of participants, a non-probability convenience sampling strategy and snowball sampling were used. The study was published in a faculty participant pool of the University of Twente to reach university students, and another sign-up link was shared through social media. Moreover, participants were asked to share the study with their friends after completing the study, and students in study areas on campus were invited to participate. To partake in this study, participants needed to be university students fluent in English and have no colour vision deficiency. Participants were informed about these criteria before they agreed to participate. The final sample of 30 participants consisted of six who identified as male (20%) and 24 who identified as female (80%). The mean age was 23.60 years (SD = 2.28), ranging from 19 to 28. In the sample, two participants were Dutch (6.70%), 25 were German (83.80%), and three were of other nationalities (10.00%), namely French, Mexican, and Croatian. Each exposure condition was presented to ten participants. No participants were excluded from the sample. The Ethics Committee of the Faculty of Behavioural, Management, and Social Sciences (BMS)/ Domain Humanities & Social Sciences of the University of Twente approved this study with request number 250471.

Materials

Exposure Conditions

The three exposure conditions (S = *short-form videos*; D = *long-form documentary*; R = *reading*) were created. The SFV condition consisted of a set of 140 TikTok videos that were centred around the themes of student life, travelling, animals, food, and living in the Netherlands, as these are the most popular content categories (Izea, 2024) and they also include niche interests such as life in the Netherlands that might potentially appeal to all participants. All videos were in English and did not include any political opinions or content that might be triggering to participants. Participants were asked to watch these videos on an Apple iPhone and were free to decide how long they spent watching each video.

In the long-form documentary condition, participants were asked to watch the first ten minutes of a nature documentary (Scenic Relaxation, 2021). The same phone was used for the administration of this condition as for the SFVs to control for the effects of screen size.

For the reading condition, participants received the book "Harry Potter and the Philosopher's Stone" (Rowling, 1997) and were asked to read an excerpt from chapter two.

Stroop Word and Colour Test

The ability to inhibit cognitive interference was assessed using the Stroop Word and Colour Test (SCWT; Scarpina & Tagini, 2017). Adequate test-retest reliability of the test has been demonstrated (Strauss et al., 2005). The software PsyToolkit was used to conduct the SCWT online (Stoet, 2010, 2016). In the programme, participants were presented with 60 trials of words (green, red, blue, yellow), one after another, all printed in different ink colours on a black background. For 200 milliseconds before the word was presented, a white fixation cross indicated where the word would appear. The participants needed to press the key on a QWERTY keyboard corresponding to the ink colour of the word (g, r, b, y). For instance, if the word was printed in blue, they needed to press the b key even if the word read "green". The trials were either congruent, when the colour words and the ink in which they were printed matched, or incongruent, where the word and the ink colour did not match (e.g. YELLOW printed in red). Immediate feedback to the response was given in the form of the word "correct" or "wrong" appearing for 500 milliseconds. The programme measured their reaction time in milliseconds to the different trials and the accuracy of the responses. There are several possibilities for scoring the SCWT depending on the method of implementation of the test (Scarpina & Tagini, 2017). This study used a method where the mean response time in the congruent trials was subtracted from the mean in the incongruent trials. The difference is called

the Stroop effect (Dvorak, 2024) and a higher difference and a lower accuracy rating are indicative of lower inhibitory control (Heidlmayr et al., 2013).

Academic Procrastination Scale

The Academic Procrastination Scale (APS; see Appendix B; McClosky, 2011) assesses students' procrastination levels using 25 items formulated in statements such as "I put off projects until the last minute". The statements are rated on a five-point Likert scale (1 = *disagree*; 2 = *somewhat disagree*; 3 = *neither agree nor disagree*; 4 = *somewhat agree*; 5 = *agree*). Five items were reverse-scored, and higher scores indicate a higher tendency to procrastinate in an academic context. The APS is unidimensional and showed high reliability in this sample with a Cronbach's Alpha of .88 and a high convergent validity in correlation with other scales of procrastination (Tuckman Procrastination Scale; r = .84; McClosky, 2011). Scores were computed by first recoding the negatively scored items and then calculating a mean score for each participant.

Demographic Questionnaire

All surveys and questionnaires were conducted online using the software Qualtrics (BMS DataLab, 2025). Questionnaires included demographic questions about participants age, gender ("female", "male", "non-binary/ third gender", "prefer not to say"), nationality and usual social media habits, for instance, "If you are willing to share, what was your average screen time last week?" measured in minutes.

Questionnaire on Subjective Experience

Moreover, a questionnaire was used with five items regarding the participants' subjective experience when completing the second round of the SCWT (see Appendix C). This scale included statements such as "I found it harder to concentrate when completing the Stroop test for the second time" and was rated on a five-point Likert scale (1 = *disagree*; 2 = *somewhat disagree*; 3 = *neither agree nor disagree*; 4 = *somewhat agree*; 5 = *agree*). After reversing Item 4, higher scores indicated more experienced difficulties with the second round of the SCWT after the exposure. The scale had a high reliability (α = .82).

Procedure

The procedure of the experiment was the same for each of the three participant groups, with the only difference consisting of the type of exposure the participants received in each condition. The study was conducted in person and different project rooms.

First, participants were asked to fill out the informed consent form (see Appendix D). In this form, they were purposely not told that the aim of the study was to measure differences in inhibitory control after different types of exposure. This might have influenced the way they

consumed the media, and their expectations might have affected scores on the post-test. Instead, they were told that the cognitive processes involved in academic procrastination would be studied. Afterwards, they had the opportunity to ask questions.

Then, participants completed a first round of the SCWT in a web-based version (Stoet, 2010, 2016). Overall, participants spent around five minutes on this test.

Afterwards, participants were asked to complete a demographic questionnaire, the APS, and a self-report on their SFV consumption. Completing the questionnaires took around five minutes in total.

Next was the exposure phase with the three different conditions. The exposure lasted for ten minutes for all participants. Afterwards, all participants completed a second round of the SCWT with the same instructions, which took around five minutes, after which they were asked about their subjective experience during this round compared to the first round. Lastly, they were debriefed about the true aim of the study and had the option to withdraw their consent. The total time spent on the experiment varied between 25 and 30 minutes per participant.

Data Analysis

First, the data from the Stroop test was manually joined into one data file, including the trials from all participants to be analysed further using the statistical software RStudio (v4.4.2; R Core Team, 2024). The R packages used for the analysis were tidyverse (v2.0.0; Wickham et al., 2019), janitor (v2.2.1; Firke, 2024), broom (v1.0.7; Robinson et al., 2024), psych (v2.5.3; Revelle, 2025), CTT (v2.3.3; Willse, 2018), modelr (v0.1.11; Wickham, 2023), afex (v1.4-1; Singmann et al., 2024), emmeans (v1.11.1; Lenth 2025), ggplot2 (Wickham, 2016), car (Fox & Weisberg, 2019), and rstatix (v0.7.2; Kassambara, 2023). The R Script can be found in Appendix E.

Descriptive statistics for the demographic variables of “age”, “gender”, and “nationality” were calculated. Afterwards, items 1, 8, 12, 14, and 25 of the APS were inverse coded, and descriptive statistics were calculated based on the scores of the APS. Moreover, Cronbach’s alpha was calculated for the APS to determine whether the scores were reliable. All items were kept in the final scale, since no exclusion would have significantly impacted the reliability of the test.

For each participant and round of the SCWT, the mean reaction times for the congruent trials and for the incongruent trials were calculated. Then, the Stroop effect was calculated by subtracting the mean reaction time in milliseconds in the congruent trials from the mean in the incongruent trials for each round and participant. A one-way ANOVA was conducted on the

data of the Stroop effect to determine whether the condition created a significant difference in the post-test scores. Scores were considered significant for p-values < .05.

Afterwards, to test hypotheses H1 and H2, the dataset was transformed for further analysis. A Mixed ANOVA model was applied to test hypotheses H1 and H2 with the within-subject factor of the different rounds and the between-subject factor of the three group conditions. The assumptions for the ANOVA model were tested. The assumption of normality was tested using the Shapiro-Wilk test, and the assumption of homogeneity of variances was tested using Levene's test. An influence plot was used to test the assumption of no significant outliers, and the assumption of homogeneity of covariances was assessed using Box's M. When an assumption was not met, a Robust Mixed ANOVA was performed instead. Afterwards, post hoc analyses were conducted, comparing the groups across rounds and the rounds across groups.

To test hypothesis H3, a Mixed ANOVA with the moderator variable of the mean APS score was conducted, and the assumptions for the model were tested. Afterwards, post hoc analyses were performed to compare the groups within each round first and then compare the rounds within each group.

For hypothesis H4, the mean scores for the variable "average screen time the week before" were calculated in minutes. To fill in the four missing values and because of the large range between scores, the variable was centred by subtracting the mean screen time from the value of each participant. A Mixed ANOVA including the moderator variable of average screen time was conducted. Post hoc analyses were performed comparing the rounds and the groups.

An analysis of descriptive statistics was conducted for the questionnaire on subjective experience across groups. For the descriptive statistics of each group, the coding of Item 4 was reversed, and a scale score was created by calculating the mean of all five questions for each participant. Cronbach's Alpha was calculated for the reliability of this scale. With this scale score, a linear model was conducted with the exposure condition as the independent variable and the scale score as the dependent variable. The assumptions of a linear model were checked.

Results

The descriptive statistics for the variables of the Stroop effect in the two rounds in milliseconds, the Academic Procrastination Scale (APS), the screen time in minutes, and the subjective experience can be found in Table 1. The mean Stroop effect in the sample for the first round was 103.90 (*SD* = 87.05). For the second round, the mean Stroop effect was 127.19 (*SD* = 88.71). The scores in Condition R were lower compared to the other two groups in both

rounds. The mean score on the APS was 2.48 (*SD* = 0.54), with participants' mean scores ranging from 1.48 to 3.68. The screen time of participants ranged from 120 to 510 minutes, with a mean of 247 (*SD* = 139), which was used to centre the variable for the analysis.

Table 1

Descriptive Statistics of all Dependent Variables

Variable	Condition	*M*	*SD*
Stroop Effect Round 1[a]	Across	103.90	87.05
	S	135.40	23.23
	D	98.39	29.96
	R	77.90	28.57
Stroop Effect Round 2[a]	Across	127.19	88.71
	S	160.38	24.91
	D	150.86	24.39
	R	70.32	27.86
APS[b]	Across	2.48	0.54
	S	2.23	0.40
	D	2.56	0.62
	R	2.66	0.53
Screen Time[c]	Across	247	139
	S	255	123
	D	271	95.3
	R	215	191
Subjective Experience[d]	Across	2.61	0.97
	S	3.14	0.33
	D	2.30	0.97
	R	2.38	0.85

Note. S = short-form videos; D = documentary; R = reading

[a] measured in milliseconds. [b] measured with a five-point Likert scale. [c] measured in minutes. [d] measured with a five-point Likert scale, with Item 4 reverse coded so that a higher mean scale score indicated more difficulties in the second round.

As a manipulation check, a one-way ANOVA was conducted on the Stroop effect post-intervention. This analysis showed that exposure had a statistically significant effect on the Stroop effect post-intervention ($F(2, 27) = 3.69$, $p = .038$) while this significance could not be found in the pre-intervention Stroop effect ($F(2,27) = 1.13$, $p = .338$), meaning that the intervention was deemed successful.

Differences Between Exposure Conditions

A Mixed ANOVA was conducted with the within-subjects factor of the round on the Stroop test and the between-subjects factor of the exposure condition. The necessary assumptions were tested for this model. The assumption of normality and the assumption of no extreme outliers were not met. Hence, a Robust Mixed ANOVA was conducted to test Hypotheses 1 and 2 with the independent variables of condition and round and the dependent variable of the Stroop effect (see Table 2). The analysis revealed that there is a trend that there might be difference between the Stroop effects between conditions regardless of time ($F(2,27) = 3.19$, $p = .057$) but that there is no significant change from pre-intervention to post-intervention across all groups ($F(1,27) = 1.55$, $p = .223$) and that the interaction effect between condition and round was also not significant ($F(2,27) = 0.86$, $p = .433$).

Table 2

Robust Mixed ANOVA for Hypotheses 1 and 2

	Df	Df	*F*	*p*
(Intercept)	1	27	89.88	<.001***
Condition	2	27	3.19	.057 .
Round	1	27	1.55	.223
Condition: round	2	27	0.86	.433

.$p < .1$. *$p < .05$. ***$p < .001$

To determine which conditions differed, a post-hoc comparison was conducted, comparing the Stroop effects between conditions and rounds. The outcome can be found in Table 3. It shows that there is a trend visible that there is a negative difference in the Stroop effects between the conditions R and S in the second round of the Stroop test ($\beta = -90.07$, $p = .051$). Generally, the scores in condition R were lower compared to the other conditions.

Table 3

Post-Hoc Group Comparisons by Condition and by Round

Round/ Condition	Contrast	Estimate	*p*
Condition S	Round 1 – Round 2	-24.98	.447
Condition D	Round 1 – Round 2	-52.48	.117
Condition R	Round 1 – Round 2	7.59	.816
Round 1	S – D	37.01	.611
	S – R	57.50	.314
	D – R	20.48	.858
Round 2	S – D	9.52	.963
	S – R	90.07	.051 .
	D – R	80.55	.087 .

Note. S = short-form videos; D = documentary; R = reading

.$p < .1$

Effect of Moderator APS

To test hypothesis H3 "Academic procrastination serves as a moderator of the relationship between exposure and inhibitory control.", a Mixed ANOVA with the within-subject factor of the Stroop test round, the between-subject factor of the condition, the random effect of the participants and the moderator of the mean APS score on the dependent variable of the Stroop effect was conducted. As can be seen in Table 4, the analysis revealed a trend that the APS might affect the scores independent of the round ($F(1,24) = 3.26$, $p = .084$). The interaction effect between the condition and the round, when controlling for the APS score, was close to the statistical level of significance ($F(2,24) = 3.24$, $p = .057$). Still, the three-way interaction between the group, the round, and the moderator of the APS was not statistically significant ($F(2,24 = 2.78$, $p = .082$). The assumptions of the ANOVA model were met.

Table 4

Mixed ANOVA with Moderator APS for Hypothesis 3

	Df	Df	*F*	*p*
(Intercept)	1	24	<0.001	.984
Condition	2	24	0.62	.546
Mean_Score_APS	1	24	3.26	.084 .
Condition: Mean_Score_APS	2	24	0.22	.800
Round	1	24	2.15	.155
Condition: Round	2	24	3.24	.057 .
Mean_Score: Round	1	24	1.70	.205
Condition: Mean_Score_APS: Round	2	24	2.78	.082 .

.$p < .1$

The post-hoc analysis displayed in Table 5 compared the differences in the Stroop effect by condition and by round when including the moderator APS. The analysis showed that in the second round, the Stroop effects from condition R were significantly lower compared to condition S ($\beta = 106.79$, $p = .037$) and condition D ($\beta = 99.95$, $p = .032$).

Table 5

Post-hoc Group Comparison by Condition and by Group, including Moderator APS

Round/ Condition	Contrast	Estimate	*p*
Condition S	Round 1 – Round 2	-1.48	.967
Condition D	Round 1 – Round 2	-61.28	.816
Condition R	Round 1 – Round 2	18.78	.559
Round 1	S – D	66.64	.251
	S – R	86.53	.116
	D – R	19.89	.861
Round 2	S – D	6.84	.984
	S – R	106.79	.037 *
	D – R	99.95	.032 *

Note. S = short-form videos; D = documentary; R = reading

*$p < .05$

Effect of Moderator Screen Time

A Mixed ANOVA with the within-subject factor of the Stroop test round, the between-subjects factor of the condition, the random effect of the participants and the moderator of the mean screen time on the dependent variable of the Stroop effect was conducted to test hypothesis H4 “Screen time serves as a moderator of the relationship between exposure and inhibitory control” (see Table 6). The analysis revealed a significant interaction effect between the screen time and the round ($F(1,24) = 5.26$, $p = .031$). Moreover, there is a trend that the condition might have an effect independent of time and the moderator ($F(2,24) = 3.07$, $p = .065$). Since the assumptions for the model were met, the model was deemed reliable.

Table 6

Mixed ANOVA with Moderator Average Screen Time for Hypothesis 4

	Df	Df	*F*	*p*
(Intercept)	1	24	87.07	<.001 ***
Condition	2	24	3.07	.065 .
Screen	1	24	0.18	.675
Condition: Screen	2	24	1.37	.273
Round	1	24	1.85	.187
Condition: Round	2	24	1.70	.204
Screen: Round	1	24	5.26	.031 *
Condition: Screen: Round	2	24	0.09	.910

.$p < .1$. *$p < .05$. ***$p < .001$

A post hoc comparison by condition and round was conducted to investigate differences in the Stroop effect (see Table 7). It showed a trend that the Stroop effect in condition D was higher in round 2 compared to round 1 ($\beta = -63.4$, $p = .055$). Moreover, there was a statistically significant positive difference between conditions S and R ($\beta = 94.34$, $p = .040$) and between conditions D and R ($\beta = 94.98$, p = .042) in the second round. Hence, the Stroop effects in condition R were lower compared to conditions S and D.

Table 7

Post-hoc Group Comparison by Condition and by Group, including Moderator Screen Time

Round/ Condition	Contrast	Estimate	*p*
Condition S	Round 1 – Round 2	-27.2	.382
Condition D	Round 1 – Round 2	-63.4	.055 .
Condition R	Round 1 – Round 2	17.8	.571
Round 1	S – D	35.60	.628
	S – R	49.38	.409
	D – R	13.78	.932
Round 2	S – D	-0.64	1.00
	S – R	94.34	.040 *
	D – R	94.98	.042 *

Note. S = short-form videos; D = documentary; R = reading

.$p < .1$. *$p < .05$.

Subjective Experience

The overall means of the scale about the subjective experience of participants, as well as the separation into groups, can be found in Table 1. The total scale mean was 2.61 (SD = 0.97). The mean differences between conditions were modelled with a linear regression model displayed in Table 8. This model revealed that the negative difference between the conditions S and D was statistically significant (β = -0.84, p = .021), just as the negative difference between the conditions S and R (β = 0.76, p = .035). The mean scale score was therefore highest for condition S (M = 3.14, SD = 0.24). The assumptions of a linear model were met; thus, the model was deemed reliable.

Table 8

Outcome Linear Regression Subjective Experience with Condition S as the Reference Category

	Estimate	*SD*	*p*
Intercept	3.14	0.24	<.001***
Condition D	-0.84	0.34	.021 *
Condition R	-0.76	0.34	.035 *

Note. S = short-form videos; D = documentary; R = reading

*$p < .05$. ***$p < .001$

Discussion

This study aimed to answer the research question, "*To what extent does exposure to short-form video content influence participants' inhibitory control compared to other forms of task interruptions?".* An experimental set-up with two rounds of the Stroop Colour and Word Test (SCWT) and an interruption with three different exposure conditions was conducted with university students. To answer this research question, four hypotheses were formulated, namely

H1: *Participants exposed to short-form videos will show a greater decline in inhibitory control compared to those who are exposed to a longer video documentary.*

H2: *Participants exposed to short-form videos will show a greater decline in inhibitory control compared to those who read.*

H3: *Academic procrastination serves as a moderator of the relationship between exposure and inhibitory control.*

H4: *Screen time serves as a moderator of the relationship between exposure and inhibitory control.*

None of the hypotheses could be accepted. Nevertheless, other valuable findings and trends were revealed by the analyses.

Better Performance in the Reading Condition

A result from all of the analyses was that the participants in the reading condition tended to perform better in the second round of the Stroop test compared to the SFV condition, as well as the documentary condition. This trend was significant in the two models that included the moderators of academic procrastination and screen time. Even further, participants who were reading tended to improve their performance on the SCWT in the second round, contradicting H2. A possible explanation for this trend could be the nature of the intervention. In the two video conditions, participants were passively watching the content, while participants needed to be more cognitively active in the reading condition (Rayner & Reichle, 2010). Instead of depleting cognitive resources, reading might have strengthened them (Sultan & Fatima, 2025). Additionally, being cognitively active might have prepared participants to maintain this vigilance during the Stroop test. Therefore, participants who were reading might have had fewer difficulties reengaging since they never stopped being cognitively engaged in comparison to the video conditions. Therefore, they might have been more engaged with the exposure material.

Moderator Academic Procrastination

The moderator model that included the APS revealed another valuable trend, namely the effect of the mean score on the APS when controlling for the condition and the round. This

means that participants with a stronger tendency to procrastinate tended to have a higher Stroop effect and therefore performed worse. This trend shows the negative consequences that procrastination behaviour can have on academic performance (Kim & Seo, 2015). Furthermore, although it is unknown what activities participants with a tendency to procrastinate most often engage in, it is possible to assume that many of them use social media, considering usual student and consumer habits and age statistics (Fentaw et al., 2022; Linlin et al., 2023). Therefore, it might be possible that participants who have a higher tendency to procrastinate are more susceptible to the effects of video content because they might engage with it more frequently. Although H3 could not be accepted, this trend gives ground for further research to be conducted and highlights the motivation behind the research question.

Moderator Screen Time

The third model, including the mean screen time of participants as a moderator, revealed a significant interaction effect between the average screen time of participants and the round of the Stroop effect. Participants with a higher screen time thereby had a higher Stroop effect in the first round, meaning that they performed worse compared to those with a lower screen time. This aligns with the findings by Chen (2021) that a higher screen time can be connected to lower inhibitory control. Since this relationship could not be found for the second round, it might be that participants with a higher screen time have developed self-regulation strategies for being able to maintain task performance or have found possibilities of compensating for exposure effects, although these effects have not been researched.

Subjective Experience

Although the ANOVA without the moderators did not show any significant influence of the intervention on the Stroop effect of participants during the second round, there were differences between the groups in how they experienced this second round. Participants from the short-form video condition reported more difficulties concentrating compared to the documentary and the reading condition. Since this difference could not be found in the Stroop effect, it might be that participants were able to compensate for this effect. It might be possible that another cognitive process was involved in this experiment that the Stroop effect was unable to detect, like general self-control strategies (Duckworth et al., 2016). It might also be that an unknown cognitive process or function supplemented inhibitory control so that participants could perform similarly.

Effect of Condition

Lastly, in the main analysis for H1 and H2, as well as in the model that included the moderator of screen time, a trend was visible showing that there were differences when looking

at the overall effect of condition. This might be due to differences within the groups, independent of the intervention. The mean ages, gender distribution, procrastination habits, and screen times were similar across the groups. Still, other variables might have been responsible for these effects. One of them might be the environment in which the study was conducted, which might have had an influence on participants' attentional capacity. In total, three different environments were used, and even though they were cleared of distractions, it might have been those differences in lighting, background noises, or other people that impacted participants' performances on the SCWT. Another possibility is that, since the study was conducted at different times of day, some emotional or motivational factors may have accounted for differences in participants' attentional capacities (Sultan & Fatima, 2025). Moreover, participants who have studied or were otherwise cognitively active before their participation might have been more cognitively exhausted compared to participants in the morning (Wingbermühle, 2021). This mental fatigue can be associated with decreases in performance and attention processes (Brazaitis & Satas, 2023). Although the influence of these factors cannot be verified in hindsight, they are important to mention because they show that not solely SFVs and procrastination can affect cognitive processes in a study session, but that students should consider their environment as well when they notice difficulties with reengagement.

Implications

Nevertheless, the review of multiple different studies and the inconclusive results of this study have indicated that there are many variables that can affect cognitive processes and that can be connected to task performance (Chiossi et al.,2023; Lee, 2025; Wang et al., 2025; Zheng, 2021).

Due to the uncertain implications digital or print media may have on cognitive processes and performance, a suggestion to university students would be to choose other activities to spend their breaks. Namely, they should consider the option of engaging with nature, an exposure condition that was not included in this study. Even passively enjoying nature through the windows of a classroom could have positive effects on academic scores by restoring cognitive resources (Benfield et al., 2015). Engaging with nature can restore cognitive resources by increasing attentional capacity and by decreasing physiological stress (Mason et al., 2021). It can thereby lower anxiety levels and negative emotions (Bratman et al., 2015). In contrast to breaks with digital media, where some cognitive processes seem to be depleted, Attention Restoration Theory (ART) suggests that exposure to natural environments can help to recover from attentional fatigue (Mason et al., 2021).

Strengths and Limitations

One of the strengths of the study was the choice of the exposure material. After the break, participants mentioned to the researcher that they enjoyed the material, especially Harry Potter, as the reading material and the visuals of the documentary. Although the same was mentioned for the TikTok videos, the effect of the SFVs on the Stroop effect might have been stronger if the participants had been scrolling with their own algorithms at play. Since the algorithms pick videos most aligned to the consumers' interests (Liang, 2023), the personal relevance of the materials would have been increased, which might have increased their engagement with it (Sims, 1996). However, four participants mentioned that they do not regularly watch SFVs and therefore do not necessarily have a TikTok account. Therefore, the pre-selected set of videos also allowed for examining the effect on people who are not accustomed to the effects of SFVs.

As already discussed, there was a trend that the groups differed regardless of the intervention, possibly due to environmental influences such as further distractions or different motivations of participants. The true reasons for these differences cannot be verified in hindsight and therefore pose a great limitation to this study.

Lastly, the largest limitations of this study were the limited sample size and the laboratory setting. Since every exposure condition only consisted of ten participants, the statistical power is very limited, and findings should not be generalised. Moreover, although the study aimed to isolate the distracting effect of the exposure type on inhibitory control, the environments in which students usually spend their breaks might have additional distractions, such as other people and background noises (Lee, 2025). Therefore, effects might be different and potentially stronger in reality.

Recommendations for Future Research

As a result of the discussed limitations and the results of the study, further studies are recommended to experiment with a larger sample size as well as in an environment more typical for students to study in. That way, the effect of exposure can be compared to or combined with the effects of other distractions on inhibitory control. Furthermore, due to the potential effects of switching between screen sizes, a control experiment might be of value where the Stroop test and the interventions are conducted with different screens and screen sizes to determine whether some of the similarities between the groups might be ascribed to this. Depending on the results of such a study, it might be that some of the negative consequences of short-form media and procrastination are due to the cognitive effort it takes to work with different screens (Redlinger et al., 2021).

Moreover, with an increasing number of people receiving a diagnosis of attention-deficit/ hyperactivity disorder (ADHD; Davidovitch et al., 2017), it might be possible that the same holds for some of the participants. Therefore, future studies are recommended to include a measure for that. Since these participants already have more difficulties compared to other students in filtering out distractions, the effects of SFVs may be stronger for them (Chen et al., 2022). Additionally, more frequent use of digital media could influence the symptoms of ADHD (Chen, 2021), making the effect of the moderator screen time more severe.

This study included a standardised set of SFVs. In future studies, it could be valuable to have participants watch these videos from their own feeds since the algorithms are tethered to their interests. That might increase the effects of exposure because they might be more engaged with the content (Sims, 1996). Many consumers of these platforms also use them to stay informed about current news and political events (Kim & Fan, 2024). This study aimed to exclude any triggering content, but if students watch any SFVs that they find concerning or mentally stressful, then they might have more difficulties returning to an academic task and reengaging with the material. Therefore, it is suggested that future studies should also include a measure of how engaged and emotionally involved the participants are after the exposure break and what kind of content they decided to watch from their feed.

Lastly, the questionnaire about the subjective experience of participants revealed that there were differences between the groups on how they felt after the exposure break. The possible explanation of the involvement of another cognitive process could be tested by reconstructing the setup of this study with the exception that participants' cognitive function is monitored, for example, through an EEG or another type of measure. For this type of task, the event-related potentials in the prefrontal and the motor cortex could be of interest, since they are involved in inhibition and because the SCWT involves the motor action of pressing different buttons (Munakata et al., 2011). It might be possible that the imaging techniques reveal differences between the conditions that the SCWT was unable to detect.

Conclusion

To conclude, it can be said that further research is needed to fully answer the research question. This study has revealed that academic procrastination might moderate the relationship between different types of exposure and performance on a test measuring inhibitory control. Moreover, the average screen time might give valuable insights into general variances in inhibitory control of students. Especially the difference between cognitively active break activities, such as reading, and more passive forms of spending a break by watching video content became prominent. Moreover, short-form video content influences the perception of

the task performance, indicating that even if it cannot be concluded with certainty that inhibitory control is affected, some other cognitive processes are, which makes reengaging after procrastinating more difficult. The subjective experience of students should not be disregarded, and further research should be conducted to explain these difficulties in reengaging.

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Appendix A

Use of Generative AI

During the preparation of this work, the author used Scribbr in order to receive an initial structuring of the reference list in APA format. Moreover, Grammarly and ChatGPT were used to correct the spelling and grammar of the document, and ChatGPT was also used to correct and generate R codes for data analysis. After using these tools/services, the author reviewed and edited the content as needed and takes full responsibility for the content of the work.

Appendix B

Academic Procrastination Scale (APS; McClosky, 2011)

Please indicate the extent to which you agree with the following statements. (1 = *disagree* and 5 = *agree*)

1. I usually allocate time to review and proofread my work. *
2. I put off projects until the last minute.
3. I have found myself waiting until the day before to start a big project.
4. I know I should work on schoolwork, but I just don't do it.
5. When working on schoolwork, I usually get distracted by other things.
6. I waste a lot of time on unimportant things.
7. I get distracted by other, more fun, things when I am supposed to work on schoolwork.
8. I concentrate on schoolwork instead of other distractions. *
9. I can't focus on schoolwork or projects for more than an hour until I get distracted
10. My attention span for schoolwork is very short.
11. Tests are meant to be studied for just the night before.
12. I feel prepared well in advance for most tests. *
13. "Cramming" and last-minute studying is the best way that I study for a big test.
14. I allocate time so I don't have to "cram" at the end of the semester. *
15. I only study the night before exams.
16. If an assignment is due at midnight, I will work on it until 11:59.
17. When given an assignment, I usually put it away and forget about it until it is almost due.
18. Friends usually distract me from schoolwork.
19. I find myself talking to friends or family instead of working on schoolwork.
20. On the weekends, I make plans to do homework and projects, but I get distracted and hang out with friends.
21. I tend to put off things for the next day.
22. I don't spend much time studying school material until the end of the semester.
23. I frequently find myself putting important deadlines off.
24. If I don't understand something, I'll usually wait until the night before a test to figure it out.
25. I read the textbook and look over notes before coming to class and listening to a lecture or teacher. *

* Indicates reverse-scored items

Appendix C

Control Questionnaire After Second Round of SCWT

Please indicate the extent to which you agree with the following statements. (1 = *disagree* to 5 = *agree*)

1. Completing the Stroop test for the second time felt more difficult than the first.
2. I found it harder to concentrate when completing the Stroop test for the second time.
3. After the break, I felt the same as before the break.
4. The first round of the Stroop test felt more difficult than the second round.
5. Both rounds of the Stroop test felt equally challenging.

Appendix D

Participant Consent Form

Consent Form to Be Completed Before the Study

Brief Summary of the Project

You are invited to participate in a research study for a bachelor's thesis in educational psychology to examine cognitive processing in university students. Before you decide to participate, please read this information carefully.

In the following study, you will be asked to complete a cognitive task called the Stroop Colour and Word Test two times with a 10-minute intermission in between. The aim of the study is to examine how the cognitive processes involved in completing the test develop over time. You will receive further information from the researcher on the instructions for the test. During the 10-minute break, you will be provided with some material. Participation is estimated to take around 30 minutes.
Your scores and responses will be treated anonymously and will be used solely for the purpose of this Bachelor's thesis. No personally identifiable information will be collected, and the data will only be shared with the research team.
There are no risks associated with participation in this study.
Your participation in this study is voluntary and you can withdraw at any time, without having to give a reason.

For any further questions, please contact

Svea Wille s.wille@student.utwente.nl
Pascal Wilhelm p.wilhelm@utwente.nl
Alieke van Dijk a.m.vandijk@utwente.nl

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher, please contact the Secretary of the Ethics Committee/domain Humanities & Social Sciences of the Faculty of Behavioural, Management and Social Sciences at the University of Twente by ethicscommittee-hss@utwente.nl.

I have read and understood the study information dated 23.03.2025 or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.

O yes O no

I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.

O yes O no

Consent Form to Debrief Participants After the Study

Thank you for participating in this study. Before we resume this session, I would like to inform you about the true purpose of this study.

This study aimed to examine the impact of different types of exposure (short-form videos, reading, or watching a long-form video) on the cognitive process of inhibitory control similar to a study break. To ensure that the participants' behaviour during the exposure or the second round of the Stroop Test was not influenced by prior knowledge or expectations, this information was not disclosed beforehand.

For any further questions please contact

Svea Wille s.wille@student.utwente.nl
Pascal Wilhelm p.wilhelm@utwente.nl
Alieke van Dijk a.m.vandijk@utwente.nl

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher, please contact the Secretary of the Ethics Committee/domain Humanities & Social Sciences of the Faculty of Behavioural, Management and Social Sciences at the University of Twente by ethicscommittee-hss@utwente.nl.

Thank you again for your participation! Your contribution is valuable in helping us understand the effects of digital media on cognitive function.

After having received this information, I still consent to my data being used for this research.

O yes O no

Appendix E

R Script

```
###1 install and activate packages
install.packages("tidyverse")
install.packages("broom")
install.packages("janitor")
install.packages("psych")
install.packages("CTT")
install.packages("modelr")
install.packages("afex")
install.packages("emmeans")
install.packages("ggplot2")
install.packages("car")
install.packages("rstatix")
library("tidyverse")
library("broom")
library("janitor")
library("psych")
library("CTT")
library("modelr")
library("afex")
library("emmeans")
library("ggplot2")
library("car")
library("rstatix")

###2 demographics analysis
##frequency table nationality
Qualtrics  %>%
  tabyl(Nationality) %>%
  adorn_totals("row") %>%
  adorn_pct_formatting()
##frequency table gender
Qualtrics %>%
  tabyl(Gender) %>%
  adorn_totals("row") %>%
  adorn_pct_formatting()
##frequency table condition
Qualtrics %>%
  tabyl(Condition) %>%
  adorn_totals("row") %>%
  adorn_pct_formatting()
##summary age
Qualtrics <- Qualtrics %>%
  mutate(Age = as.numeric(Age))
Qualtrics %>%
  summarise(mean = mean(Age), sd = sd(Age), var = var(Age), minimum = min(Age),
            maximum = max(Age))
```

###3 analysis Academic Procrastination Scale

```
##create a new data set for only the 25 items from the APS
APS <- Qualtrics %>%
  select(ID,APSQ1:APSQ25)
##rename responses to numbers and reverse the coding for Q1,Q8,Q12,Q14,Q25
APS <- APS %>%
  mutate(APSQ1 = dplyr::recode(as.character(APSQ1),
                               "Agree" = 1,
                               "Somewhat agree" = 2,
                               "Neither agree nor disagree" = 3,
                               "Somewhat disagree" = 4,
                               "Disgree" = 5))
APS <- APS %>%
  mutate(APSQ1 = dplyr::recode(as.character(APSQ1),`Agree` = 1, `Somewhat agree` = 2,
`Neither agree nor disagree` = 3, `Somewhat disagree` = 4, `Disagree` = 5))
APS <- APS %>%
  mutate(APSQ2 = dplyr::recode(as.character(APSQ2), `Disagree` = 1, `Somewhat disagree`
= 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ3 = dplyr::recode(as.character(APSQ3), `Disagree` = 1, `Somewhat disagree`
= 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ4 = dplyr::recode(as.character(APSQ4), `Disagree` = 1, `Somewhat disagree`
= 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ5 = dplyr::recode(as.character(APSQ5), `Disagree` = 1, `Somewhat disagree`
= 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ6 = dplyr::recode(as.character(APSQ6), `Disagree` = 1, `Somewhat disagree`
= 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ7 = dplyr::recode(as.character(APSQ7), `Disagree` = 1, `Somewhat disagree`
= 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ8 = dplyr::recode(as.character(APSQ8), `Agree` = 1, `Somewhat agree` = 2,
`Neither agree nor disagree` = 3, `Somewhat disagree` = 4, `Disagree` = 5))
APS <- APS %>%
  mutate(APSQ9 = dplyr::recode(as.character(APSQ9), `Disagree` = 1, `Somewhat disagree`
= 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ10 = dplyr::recode(as.character(APSQ10), `Disagree` = 1, `Somewhat
disagree` = 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ11 = dplyr::recode(as.character(APSQ11), `Disagree` = 1, `Somewhat
disagree` = 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ12 = dplyr::recode(as.character(APSQ12), `Agree` = 1, `Somewhat agree` = 2,
`Neither agree nor disagree` = 3, `Somewhat disagree` = 4, `Disagree` = 5))
APS <- APS %>%
```

```
  mutate(APSQ13 = dplyr::recode(as.character(APSQ13), `Disagree` = 1, `Somewhat
disagree` = 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ14 = dplyr::recode(as.character(APSQ14), `Agree` = 1, `Somewhat agree` = 2,
`Neither agree nor disagree` = 3, `Somewhat disagree` = 4, `Disagree` = 5))
APS <- APS %>%
  mutate(APSQ15 = dplyr::recode(as.character(APSQ15), `Disagree` = 1, `Somewhat
disagree` = 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ16 = dplyr::recode(as.character(APSQ16), `Disagree` = 1, `Somewhat
disagree` = 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ17 = dplyr::recode(as.character(APSQ17), `Disagree` = 1, `Somewhat
disagree` = 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ18 = dplyr::recode(as.character(APSQ18), `Disagree` = 1, `Somewhat
disagree` = 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ19 = dplyr::recode(as.character(APSQ19), `Disagree` = 1, `Somewhat
disagree` = 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ20 = dplyr::recode(as.character(APSQ20), `Disagree` = 1, `Somewhat
disagree` = 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ21 = dplyr::recode(as.character(APSQ21), `Disagree` = 1, `Somewhat
disagree` = 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ22 = dplyr::recode(as.character(APSQ22), `Disagree` = 1, `Somewhat
disagree` = 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ23 = dplyr::recode(as.character(APSQ23), `Disagree` = 1, `Somewhat
disagree` = 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ24 = dplyr::recode(as.character(APSQ24), `Disagree` = 1, `Somewhat
disagree` = 2, `Neither agree nor disagree` = 3, `Somewhat agree` = 4, `Agree` = 5))
APS <- APS %>%
  mutate(APSQ25 = dplyr::recode(as.character(APSQ25), `Agree` = 1, `Somewhat agree` = 2,
`Neither agree nor disagree` = 3, `Somewhat disagree` = 4, `Disagree` = 5))
##descriptive analysis of APS
include_cols <- c("APSQ1", "APSQ2", "APSQ3", "APSQ4", "APSQ5", "APSQ6", "APSQ7",
"APSQ8", "APSQ9", "APSQ10", "APSQ11", "APSQ12", "APSQ13", "APSQ14", "APSQ15",
"APSQ16", "APSQ17", "APSQ18", "APSQ19", "APSQ20", "APSQ21", "APSQ22",
"APSQ23", "APSQ24", "APSQ25")
APS$Mean_Score <- rowMeans(APS[ , include_cols], na.rm = TRUE)
APS_stats <- APS %>%
  summarise(mean = mean(Mean_Score), sd = sd(Mean_Score), var = var(Mean_Score),
minimum = min(Mean_Score),
          maximum = max(Mean_Score))
print(APS_stats)
##inlcude condition into the data set with the APS
```

```
id_condition <- Qualtrics %>%
  select(ID, Condition) %>%
  distinct()
##join Condition into stroop_combined using ID
APS <- APS %>%
  left_join(id_condition, by = "ID")
##descriptive statistics by Condition
APS %>%
  group_by(Condition) %>%
  summarise(
    count = n(),
    mean = mean(Mean_Score, na.rm = TRUE),
    sd = sd(Mean_Score, na.rm = TRUE),
    min = min(Mean_Score, na.rm = TRUE),
    max = max(Mean_Score, na.rm = TRUE)
  )
##Cronbach's alpha for APS
result <- APS %>%
  select(2:26) %>%
  as.matrix() %>%
  itemAnalysis()
result$alpha
result$itemReport
```

###4 analysis of Stroop Data

```
##mean reaction times for each participant round 1 and 2 without determining congruency
mean_rts <- Stroop %>%
  group_by(ID) %>%
  summarise(
    mean_stroop1_RT = mean(stroop1_RT, na.rm = TRUE),
    mean_stroop2_RT = mean(stroop2_RT, na.rm = TRUE)
  )
##mean reaction times including whether trials were congruent
stroop1_means <- Stroop %>%
  group_by(ID, stroop1_congruent) %>%
  summarise(mean_stroop1_RT = mean(stroop1_RT, na.rm = TRUE), .groups = "drop")
stroop2_means <- Stroop %>%
  group_by(ID, stroop2_congruent) %>%
  summarise(mean_stroop2_RT = mean(stroop2_RT, na.rm = TRUE), .groups = "drop")
stroop1_means <- stroop1_means %>%
  rename(congruent = stroop1_congruent) %>%
  mutate(round = "stroop1")
stroop2_means <- stroop2_means %>%
  rename(congruent = stroop2_congruent) %>%
  mutate(round = "stroop2")
##Stroop effect
stroop1_wide <- stroop1_means %>%
  pivot_wider(names_from = congruent, values_from = mean_stroop1_RT,
              names_prefix = "congruent_") %>%
  mutate(stroop1_effect = congruent_0 - congruent_1)
```

```
stroop2_wide <- stroop2_means %>%
  pivot_wider(names_from = congruent, values_from = mean_stroop2_RT,
              names_prefix = "congruent_") %>%
  mutate(stroop2_effect = congruent_0 - congruent_1)
stroop1_wide <- stroop1_wide %>%
  rename(stroop1_congruent_0 = congruent_0,
         stroop1_congruent_1 = congruent_1) %>%
  select(ID, stroop1_congruent_0, stroop1_congruent_1, stroop1_effect)
stroop2_wide <- stroop2_wide %>%
  rename(stroop2_congruent_0 = congruent_0,
         stroop2_congruent_1 = congruent_1) %>%
  select(ID, stroop2_congruent_0, stroop2_congruent_1, stroop2_effect)
stroop_combined <- full_join(stroop1_wide, stroop2_wide, by = "ID")
stroop_combined <- stroop_combined %>%
  mutate(stroop_effect_change = stroop2_effect - stroop1_effect)
##descriptive statistics Stroop effect
stroop_stats1 <- stroop_combined %>%
  summarise(mean = mean(stroop1_effect), sd = sd(stroop1_effect), var = var(stroop1_effect),
minimum = min(stroop1_effect),
            maximum = max(stroop1_effect))
stroop_stats2 <- stroop_combined %>%
  summarise(mean = mean(stroop2_effect), sd = sd(stroop2_effect), var = var(stroop2_effect),
minimum = min(stroop2_effect),
            maximum = max(stroop2_effect))
##inlcude condition into the data set with the Stroop effect
id_condition <- Qualtrics %>%
  select(ID, Condition) %>%
  distinct()
##join Condition into stroop_combined using ID
stroop_combined <- stroop_combined %>%
  left_join(id_condition, by = "ID")
```

###5 manipulation check on post test data

```
stroop_long <- stroop_combined %>%
  pivot_longer(cols      = c(stroop1_effect, stroop2_effect),
               names_to  = 'round',
               values_to = 'effect')
post_test <- subset(stroop_long, round == "stroop2_effect")
model_check <- aov(effect ~ Condition, data = post_test)
summary(model_check)
TukeyHSD(model_check)
pre_test <- subset(stroop_long, round == "stroop1_effect")
model2_check <- aov(effect ~ Condition, data = pre_test)
summary(model2_check)
TukeyHSD(model2_check)
##descriptive statistics pre-test data
summary_pre <- pre_test %>%
  group_by(Condition) %>%
  summarise(
    mean_effect = mean(effect, na.rm = TRUE),
```

```
    se = sd(effect, na.rm = TRUE) / sqrt(n())
  ) %>%
  mutate(Time = "Pre")
##descriptive statistics post-test data
summary_post <- post_test %>%
  group_by(Condition) %>%
  summarise(
    mean_effect = mean(effect, na.rm = TRUE),
    se = sd(effect, na.rm = TRUE) / sqrt(n())
  ) %>%
  mutate(Time = "Post")
##table means pre/post by condition
combined_summary <- bind_rows(summary_pre, summary_post)
combined_summary$Time <- factor(combined_summary$Time, levels = c("Pre", "Post"))
```

###6 Mixed ANOVA

```
anova_result <- aov_ez(
  id = "ID",
  dv = "effect",
  data = stroop_long,
  within = "round",
  between = "Condition"
)
summary(anova_result, confint = TRUE)
anova_model <- aov_car(effect ~ Condition * round + Error(ID/round), data = stroop_long)
##post-hoc comparisons for condition
emmeans_result <- emmeans(anova_model, ~ round * Condition)
contrast(emmeans_result, method = "pairwise", by = "Condition", adjust = "tukey")
contrast(emmeans_result, method = "pairwise", by = "round", adjust = "tukey")
##6.1 assumption of normality
stroop_long %>%
  group_by(round, Condition) %>%
  shapiro_test(effect)
##6.2 assumption of homogeneity of variance
stroop_long %>%
  group_by(round) %>%
  levene_test(effect ~ Condition)
##6.3 assumption of no significant outliers
stroop_long %>%
  group_by(round, Condition) %>%
  identify_outliers(effect)
##6.4 assumption of homogeneity of covariances
box_m(stroop_long[, "effect", drop = FALSE], stroop_long$Condition)
```

###7 moderator model including APS

```
##join Condition into stroop_combined using ID
id_APS <- APS %>%
  select(ID, Mean_Score) %>%
  distinct()
stroop_long <- stroop_long %>%
```

```
  left_join(id_APS, by = "ID")
stroop_long$Mean_Score <- as.numeric(stroop_long$Mean_Score)
str(stroop_long$Mean_Score)
##run the model
res_mod <- aov_car(
  effect ~ Condition * round * Mean_Score.x + Error(ID/round),
  data = stroop_long,
  factorize = FALSE  # Prevents automatic conversion of continuous predictors
)
summary(res_mod)
##post hoc comparisons
emm <- emmeans(res_mod, ~ round * Condition)
contrast(emm, method = "pairwise", by = "Condition", adjust = "tukey")
contrast(emm, method = "pairwise", by = "round", adjust = "tukey")
##7.1 assumption of normality
residuals <- residuals(res_mod$lm)
fitted_vals <- fitted(res_mod$lm)
shapiro.test(residuals)
qqnorm(residuals)
qqline(residuals)
##7.2 assumptions homogeneity of variance
plot(fitted_vals, residuals,
     main = "Residuals vs Fitted",
     xlab = "Fitted values",
     ylab = "Residuals")
abline(h = 0, col = "red")
plot(stroop_long$Mean_Score.x, residuals,
     main = "Moderator vs Residuals",
     xlab = "Moderator",
     ylab = "Residuals")
abline(h = 0, col = "red")
##7.3 assumption of no significant outliers
influencePlot(res_mod$lm)
##7.4 assumption of independence of residuals
durbinWatsonTest(res_mod$lm)
```

###8 moderator model including screen time

```
##join screen time into the data set
Screen_Time$`Screen Time in Minutes` <- as.numeric(Screen_Time$`Screen Time in
Minutes`)
str(Screen_Time$`Screen Time in Minutes`)
id_screentime <- Screen_Time %>%
  select(ID, `Screen Time in Minutes`) %>%
  distinct()
stroop_long <- stroop_long %>%
  left_join(id_screentime, by = "ID")
stroop_long <- stroop_long %>%
  rename(Screen = `Screen Time in Minutes` )
##descriptive statistics of Screen time
Screen_Time <- Screen_Time %>%
```

```
  rename(Screen = `Screen Time in Minutes` )
Screen_Time %>%
  group_by(Condition) %>%
  summarise(
    count = n(),
    mean = mean(Screen, na.rm = TRUE),
    sd = sd(Screen, na.rm = TRUE),
    min = min(Screen, na.rm = TRUE),
    max = max(Screen, na.rm = TRUE)
  )
Screen_Time %>%
  summarise(
    count = n(),
    mean = mean(Screen, na.rm = TRUE),
    sd = sd(Screen, na.rm = TRUE),
    min = min(Screen, na.rm = TRUE),
    max = max(Screen, na.rm = TRUE)
  )
##center the scores and run the model
stroop_long$Screen_c <- scale(stroop_long$Screen, center = TRUE, scale = FALSE)
res3_mod <- aov_car(
  effect ~ Condition * round * Screen_c + Error(ID/round),
  data = stroop_long,
  factorize = FALSE
)
summary(res3_mod)
##plot
stroop_long$round <- as.factor(stroop_long$round)
ggplot(stroop_long, aes(x = Screen_c, y = effect, color = round)) +
  geom_point(alpha = 0.6) +
  geom_smooth(method = "lm", se = TRUE) +
  labs(
    title = "Effect of Screen Time on Stroop Performance by Round",
    x = "Centered Screen Time",
    y = "Stroop Effect",
    color = "Round"
  ) +
  theme_minimal() +
  theme(
    text = element_text(size = 12),
    plot.title = element_text(hjust = 0.5, face = "bold")
  )
##post hoc comparisons
emm3 <- emmeans(res3_mod, ~ round * Condition)
contrast(emm3, method = "pairwise", by = "Condition", adjust = "tukey")
contrast(emm3, method = "pairwise", by = "round", adjust = "tukey")
##8.1 assumption of normality
residuals2 <- residuals(res3_mod$lm)
fitted_vals2 <- fitted(res3_mod$lm)
shapiro.test(residuals2)
```

```
qqnorm(residuals2)
qqline(residuals2)
##8.2 assumptions homogeneity of variance
plot(fitted_vals2, residuals2,
    main = "Residuals vs Fitted",
    xlab = "Fitted values",
    ylab = "Residuals")
abline(h = 0, col = "red")
plot(stroop_long$Screen, residuals2,
    main = "Moderator vs Residuals",
    xlab = "Moderator",
    ylab = "Residuals")
abline(h = 0, col = "red")
##8.3 assumption of no significant outliers
influencePlot(res3_mod$lm)
##8.4 assumption of independence of residuals
durbinWatsonTest(res3_mod$lm)
```

###9 analysis of the questionnaire of subjective experience

```
##rename the values according to the Likert scale
Experience <- Experience %>%
  mutate(controlQ1 = dplyr::recode(as.character(controlQ1),
                            "Disagree" = 1,
                            "Somewhat disagree" = 2,
                            "Neither agree nor disagree" = 3,
                            "Somewhat agree" = 4,
                            "Agree" = 5))
Experience <- Experience %>%
  mutate(controlQ2 = dplyr::recode(as.character(controlQ2),
                            "Disagree" = 1,
                            "Somewhat disagree" = 2,
                            "Neither agree nor disagree" = 3,
                            "Somewhat agree" = 4,
                            "Agree" = 5))
Experience <- Experience %>%
  mutate(controlQ3 = dplyr::recode(as.character(controlQ3),
                            "Disagree" = 1,
                            "Somewhat disagree" = 2,
                            "Neither agree nor disagree" = 3,
                            "Somewhat agree" = 4,
                            "Agree" = 5))
Experience <- Experience %>%
  mutate(controlQ4 = dplyr::recode(as.character(controlQ4),
                            "Disagree" = 5,
                            "Somewhat disagree" = 4,
                            "Neither agree nor disagree" = 3,
                            "Somewhat agree" = 2,
                            "Agree" = 1))
Experience <- Experience %>%
  mutate(controlQ5 = dplyr::recode(as.character(controlQ5),
```

```
                    "Disagree" = 1,
                    "Somewhat disagree" = 2,
                    "Neither agree nor disagree" = 3,
                    "Somewhat agree" = 4,
                    "Agree" = 5))
##descriptive statistics overall
Experience %>%
  summarise(mean = mean(controlQ1), sd = sd(controlQ1), var = var(controlQ1), minimum =
min(controlQ1),
        maximum = max(controlQ1))
Experience <- Experience %>%
  mutate(Age = as.numeric(controlQ2))
Experience %>%
  summarise(mean = mean(controlQ2), sd = sd(controlQ2), var = var(controlQ2), minimum =
min(controlQ2),
        maximum = max(controlQ2))
Experience %>%
  summarise(mean = mean(controlQ3), sd = sd(controlQ3), var = var(controlQ3), minimum =
min(controlQ3),
        maximum = max(controlQ3))
Experience %>%
  summarise(mean = mean(controlQ4), sd = sd(controlQ4), var = var(controlQ4), minimum =
min(controlQ4),
        maximum = max(controlQ4))
Experience %>%
  summarise(mean = mean(controlQ5), sd = sd(controlQ5), var = var(controlQ5), minimum =
min(controlQ5),
        maximum = max(controlQ5))
##descriptive statistics by group per item
Experience %>%
  group_by(Condition) %>%
  summarize(mean = mean(controlQ1), sd(controlQ1), na.rm = T)
Experience %>%
  group_by(Condition) %>%
  summarize(mean = mean(controlQ2), sd(controlQ2), na.rm = T)
Experience %>%
  group_by(Condition) %>%
  summarize(mean = mean(controlQ3), sd(controlQ3), na.rm = T)
Experience %>%
  group_by(Condition) %>%
  summarize(mean = mean(controlQ4), sd(controlQ4), na.rm = T)
Experience %>%
  group_by(Condition) %>%
  summarize(mean = mean(controlQ5), sd(controlQ5), na.rm = T)
##descriptive analysis of subjective experience for overall scale
include_colsE <- c("controlQ1", "controlQ2", "controlQ3", "controlQ4", "controlQ5")
Experience$Mean_Score <- rowMeans(Experience[ , include_colsE], na.rm = TRUE)
Experience_stats <- Experience %>%
  summarise(mean = mean(Mean_Score), sd = sd(Mean_Score), var = var(Mean_Score),
minimum = min(Mean_Score),
```

```
          maximum = max(Mean_Score))
print(Experience_stats)
Experience %>%
  group_by(Condition) %>%
  summarize(mean = mean(Mean_Score), sd(Mean_Score), na.rm = T)
##Cronbach's alpha for Experience
resultE <- Experience %>%
  select(3:7) %>%
  as.matrix() %>%
  itemAnalysis()
resultE$alpha
resultE$itemReport
##lm with experience and condition
Experience$Condition <- as.factor(Experience$Condition)
Experience$Condition <- relevel(Experience$Condition, ref="S")
exp_model_lm <- lm(Mean_Score ~ Condition, data = Experience)
summary(exp_model_lm)
```

###10 correlation analysis of dependent variables

```
##inlcude APS into the data set with stroop
id_APS <- APS %>%
  select(ID, Mean_Score) %>%
  distinct()
##join APS into stroop_combined using ID
stroop_combined <- stroop_combined %>%
  left_join(id_APS, by = "ID")
##inlcude Screen into the data set with stroop
id_screentime <- Screen_Time %>%
  select(ID, Screen) %>%
  distinct()
##join Screen into stroop_combined using ID
stroop_combined <- stroop_combined %>%
  left_join(id_screentime, by = "ID")
##inlcude subjective experience into the data set with stroop
id_exp <- Experience %>%
  select(ID, Mean_Score) %>%
  distinct()
id_exp <- id_exp %>%
  rename(Mean_Experience = `Mean_Score` )
##join subjective experience into stroop_combined using ID
stroop_long <- stroop_long %>%
  left_join(id_exp, by = "ID")
##rest prep
stroop_combined <- stroop_combined %>%
  rename(APS = `Mean_Score` )
##correlation analysis
corr.test(stroop_combined[, c("APS", "Screen", "Experience")], use = "pairwise")
vars <- c("stroop_effect_change", "Mean_Score", "Screen_c", "Mean_Experience.x")
resultc <- corr.test(stroop_combined[, vars], use = "pairwise")
print(resultc$r)
```

```
print(resultc$p)
stroop_combined %>%
  group_by(Condition) %>%
  group_split() %>%
  lapply(function(df) {
    cat("\nGroup:", unique(df$Condition), "\n")
    print(corr.test(df[, vars], use = "pairwise"))
  })
```