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Understanding Procrastination: The Role of Self-Control Strategies and Screen Time

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Understanding Procrastination: The Role of Self-Control Strategies and Screen Time

Introduction and Theoretical Background

Imagine you planned to go for a run to build up stamina. The vision of becoming a fitter and healthier version of yourself is highly motivating, with the promise of numerous advantages such as enhanced energy levels, uplifted mood, and overall improved health. Yet, these benefits are in the future and require effort to achieve. As the appointed time for your run comes, you are therefore tempted to stay on your couch a bit longer, grab your phone, scroll through social media, and create an immediately enjoyable experience instead of waiting for the rewarding feeling after your run. In other words, you procrastinate, you engage in unrelated activities, and put off tackling your resolution by going for a run. Fortunately for you, you are not alone with this behaviour. *Procrastination*, one of the most prominent self-regulation failures, is almost ubiquitous (Gröpel & Steel, 2008) with nearly 20 percent of the general population self-identifying as chronic procrastinators (Ferrari et al., 2005). The consequences of this delaying behaviour are diverse and impactful: inferior academic (Kim & Seo, 2015) and work performance with lower salaries, shorter employment tenures and an increased probability of unemployment or underemployment (Nguyen et al., 2013), poorer physical health including adverse health outcomes such as heightened stress levels and delay of treatment (Sirois et al., 2003), lower life satisfaction (Argiropoulou & Vlachopanou, 2022), and worse mental health including depression and anxiety (Beutel et al., 2016) to name just a few of them. Attempting to reduce *procrastination* behaviour, the question emerges if *self-control strategies* as a subset of self-regulation could provide the necessary help. Additionally, the role of substituting behaviours like scrolling through social media that procrastinators opt for in order to avoid working towards their goals is a topic of interest. In this thesis, which forms part of a larger project on *self-control strategies* (Roth et al., 2023) alongside the work of three other master's students, I will explore the concepts of *procrastination* and *self-control*, examine the relationship between these two variables, and investigate the mediating effect of screen time.

Procrastination

Generally, *procrastination* can be defined as voluntary postponement or avoidance of a given task, despite having control over the activity (Tuckman, 1991), and with the anticipation of experiencing negative consequences for the delay (Steel, 2007).

Apart from this common definition, *decisional* and *general procrastination* should be distinguished as their association with relevant variables like personality types is significantly different (Tibbett & Ferrari, 2015). While *general procrastination* refers to the frequency of putting off the start or completion of a task (Grund & Fries, 2018), *decisional procrastination* is about the delay of making a decision within a set period (Effert & Ferrari, 1989). Moderate intercorrelations between those two concepts have been found (Harriott & Ferrari, 1996).

For this thesis, I will only focus on *general procrastination*, as it is associated with low self-regulation (Gröpel & Steel, 2008). In comparison, *decisional procrastination* entails methodically gathering information about possible alternatives before deciding and taking more time to finish a task rather than unsystematically postponing the start of a task (Ferrari & Dovidio, 2000) and is not related to the *self-control* focus of this study.

Additionally important is the distinction of *general procrastination* from *academic procrastination*, which relates exclusively to study- and learning-related activities or tasks (Steel & Klingsieck, 2016) and is therefore only suitable when investigating students. This thesis focuses on the postponement or avoidance of everyday tasks in the general population.

Across studies, between 15 – 20 % of adults describe themselves as procrastinators (Harriott & Ferrari, 1996; Ferrari et al., 2005, 2007). *General procrastination* is prevalent across diverse populations such as men and women in various countries, including Spain, Peru, Venezuela, the United Kingdom, Australia, Israel, and the United States. It affects adults with different levels of education and appears in various areas of life, such as health habits, career decisions, and relationships (Ferrari et al., 2005, 2007; Hen & Goroshit, 2018; Steel & Ferrari, 2013). Although common across most populations, *procrastination* tends to decrease with age and is more frequently associated with men and lower education (Steel & Ferrari, 2013). Overall, it is especially prevalent in association with tasks that seem boring, annoying, difficult to complete or without an immediate reward, including examples like exercising or completing course work (Sirois & Pychyl, 2013). People who procrastinate these tasks may lack the necessary goal-setting and self-regulatory techniques to follow through (Gröpel & Steel, 2008).

Self-Control

Self-control can be defined as the ‘operational’ part of self-regulation (Gillebaart, 2018): self-regulation involves setting goals as well as planning, implementing and monitoring the execution (Carver & Scheier, 1990; Gollwitzer, 1990). *Self-control* then includes everything that is done to actively attain these goals (Gillebaart, 2018). For example,

to achieve set long-term goals (such as building stamina by running), it is often necessary to suppress and inhibit current goals (such as using your mobile phone). This mentioned ability of *inhibition* is what *self-control* has historically often been defined as (De Ridder et al., 2012) and is also the strategy that most people associate with *self-control* (Katzir et al., 2021). However, more and more researchers suggest that this cannot be the whole truth: people would constantly experience self-control failures if they only relied on the demanding strategy of *inhibition* as they would inevitably be fatigued and unable to resist (Gillebaart & De Ridder, 2015). So instead, people use routines or tactics to be able to adhere to their goals, for example, by minimising their exposure to temptations from the start or by rewarding, distracting, or punishing themselves. The specific tactics one employs depend on the particular phase of the self-control process they are. According to this Process Model of Self-Control by Duckworth et al. (2016), temptations and subsequent self-control failures can arise in four phases: (1) the presence of a tempting situation, (2) attention directed towards the temptation, (3) appraisal of the temptation, and (4) the response to the temptation. At each phase, different strategies can be employed to prevent giving in to the impulse.

Building on this Process Model of Self-Control and a set of bottom-up generated strategies identified by Hennecke and colleagues (2019), Katzir et al. (2021) designed the *Self-Control Strategy Scale* (SCSS) to operationalize the use of these *self-control strategies*, additional to traditional inhibition. The eight included strategies are grouped into three theoretical categories: the category *anticipatory control* includes the strategies *situation selection, punishment, reward,* and *pre-commitment*. To reduce the likelihood of encountering temptations, one might avoid certain situations, modify the environment to lessen temptation, set up rewards or punishments for specific behaviours, or commit to a particular behaviour in advance. *Down-regulation of temptation* encompasses the strategies *distraction, cognitive change,* and *acceptance.* Strategies to adapt the rating of the temptation include using distraction to steer focus away from the temptation, rethinking the temptation in a different context or from other perspectives and adopting a mindset of acceptance towards the temptation. The last category *behavioural inhibition* includes only the same-named strategy where the focus is on effortfully resisting giving in to the temptation. Following, the terms *inhibition* and *behavioural inhibition* will be used synonymously to describe the same-named strategy.

The use of this strategy-centred approach deepens and helps the understanding of *self-control* and self-control failure, as a wider range of *self-control* is captured compared to conventional measures like the Brief Self-Control Scale (Tangney et al., 2004) which is

especially important as none of the strategies examined by Hennecke et al. (2019) fully explained the positive impact of *trait self-control* on perceived self-regulatory success. This indicates that *trait self-control* and *self-control strategies* are distinct ways to achieve effective self-regulation: while *trait self-control* represents the general ability to manage impulses, *self-control strategies* involve targeted methods for applying that ability. The effectiveness of *trait self-control* is consequently enhanced when specific strategies are used, though the success of these strategies can vary depending on the context and the individual's level of *self-control* (Hennecke et al., 2019).

This conceptual difference is further underscored by Katzir et al. (2021): they found small, moderate, and even no correlations between *trait self-control* and the *self-control strategies*, meaning that *trait self-control* does not adequately mirror all implemented strategies.

Procrastination and self-control

There is a strong association between (trait) *self-control* and *procrastination*. *Self-control* is especially needed for starting and completing unpleasant or tedious tasks (De Ridder et al., 2012) which are exactly the kind of task that most people procrastinate on (Klingsieck, 2013). On a statistical level, *procrastination* has been found to be consistently and strongly predicted by *self-control* (Ferrari et al., 1995; Kim et al., 2017; Steel, 2007). On a conceptual level, *procrastination* has often been defined as a self-regulation failure (Rozental & Carlbring, 2014; Steel, 2007) or as the lack of *self-control* (Schouwenburg, 2005): people who procrastinate choose immediate gratification instead of working towards the long-term goal, which is a core indication of inadequate self-regulation (Tice & Baumeister, 1997). Building on the definition of *procrastination* as a self-regulation failure and the significant associations identified by Katzir and colleagues (2021) between certain *self-control strategies*—such as *punishment*, *pre-commitment*, *cognitive change*, and *inhibition*—and self-control failure, it seems reasonable to expect a significant relationship between *self-control strategies* and *procrastination*.

However, as mentioned above, *self-control* and *self-control strategies* appear to be conceptually distinct (Hennecke et al., 2019), so findings from studies on *self-control* cannot be directly applied on associations between *self-control strategies* and other variables. Therefore, the first aim of this study is to further explore the relationship between *self-control strategies* and *procrastination*.

Relationship to Screen Time

Revisiting the introductory example, a person struggles to exercise. Lacking the self-control to get up and go outside, they reach for their phone and scroll through a social media app, receiving instant gratification and procrastinating the task instead of working towards their goal. The second main aim of this study is therefore to consider the influence of the actions that people take in order to procrastinate. In this case, the chosen behaviour is the use of media and mobile phones as it is one of the most prevalent daily cravings (Yildiz Durak & Saritepeci, 2019) and the use of Facebook or mobile phones as a means to avoid working on tasks is becoming increasingly common (David et al., 2015).

This relationship has already been the focus of several papers: low *self-control* has been found to be a predictor of problematic mobile phone use (Çebi et al., 2019; Jiang & Zhao, 2016). *Academic procrastination* and problematic phone use are highly correlated (r = .42; Çebi et al., 2019; Qaisar et al., 2017) as well as *trait procrastination* is highly associated with internet addiction and not being able to control one's use of the internet (Kim et al., 2017; Reinecke et al., 2017, 2018b). A study by Meier and colleagues (2016) found that *trait self-control* significantly predicts *procrastination* through Facebook, suggesting that insufficient *self-control* can lead to using Facebook as a means to procrastinating.

Yang and colleagues (2019) then found that problematic smartphone usage acts as a mediator between self-regulation and *academic procrastination*. Gökalp et al. (2023) replicated this design with multi-screen addiction, which is the excessive and compulsive engagement with different screen-based activities (Balhara et al., 2018b), and found a significant indirect effect, indicating that multi-screen addiction significantly mediates the relationship between *self-control* and *procrastination*.

Current Study

Two research questions can now be derived from the synthesis of the preceding paragraphs: based on previous research (Ferrari et al., 1995; Kim et al., 2017; Steel, 2007), there is an association between *procrastination* and *(trait) self-control*, but *trait self-control* does not capture the whole picture of implemented strategies (Hennecke et al., 2019). The present study aimed to broaden the perspective on the relationship between *self-control* and *procrastination* by integrating the comprehensive strategy approach. Research Question 1 and the associated Hypothesis 1 are therefore about the relationship between *self-control strategies* and *procrastination*.

Hypothesis 1a - h: Each strategy of the *Self-Control Strategy Scale* is a significant predictor of lower *procrastination* while controlling for all other *self-control strategies*.

To further investigate this association, Research Question 2 and Hypothesis 2 are drawn. This is based on research by Gökalp and colleagues (2023) on the mediation of this relationship through multi-screen addiction. The research model is visualized in Figure 1.

Hypothesis 2 a - h: Screen time mediates the relationship between each individual *self-control strategy* and *procrastination* while controlling for all other *self-control strategies*.

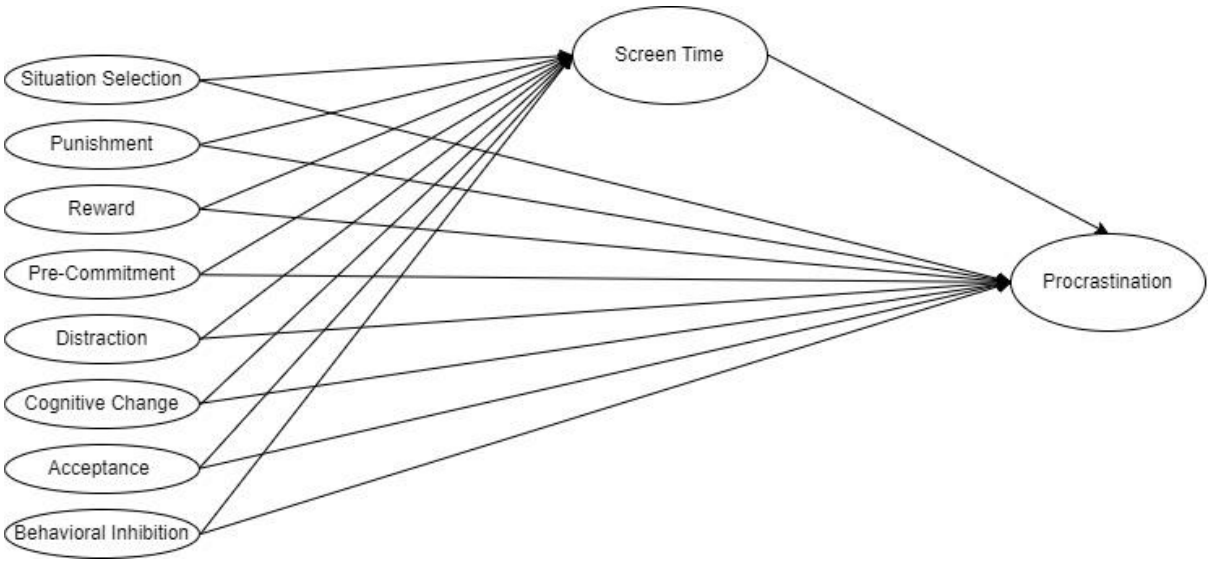

Figure 1. Research Model with Mediation

Method

Open Science and Integration

This thesis is integrated in a project by Roth et al. (2023) about the translation and validation of the German version of the SCSS. Four students, including myself, wrote their master's theses as part of this project. This project affiliation led to overlap in the theoretical background, methods, and statistical analyses as all our research questions are concerned with the predictive effect of *self-control strategies* on other constructs. However, each thesis has a different, unique focus and usually a sample of their own. The basis for this thesis is sample number 4 of the project which was collected in combination with the second online sample.

The whole project followed open science practices. This includes sharing raw and processed data, the preprocessing and analysis code as well as the manuscript. The whole study is fully available at https://osf.io/pfdt2.

Sample

Sample size was calculated using G*Power (Faul et al., 2007). Based on a multiple linear regression, partial R^2 = .05 and α = .05, a sample size of N = 600 meant a power of 99.99 % (see Appendix A). The effect size of partial R^2 = .05 has been chosen in accordance with the recommendations of Lakens (2022) as the minimum effect size of interest.

The sampling period took place from 12.02.2024 to 13.03.2024. Participants were recruited via social media. For this purpose, I created a Facebook (‘Studie zu Selbstkontrolle’) and an Instagram account (‘studiezuselbstkontrolle’). To ensure sufficient exposure to the study, we ran paid advertisements on these social media platforms. The flyers and social media accounts used for the advertisement campaigns are displayed in Appendix B. Version A-D of the flyer differ in the shown picture, as seen in the appendix, and have been used to attract different target groups. To heighten the motivation to participate, we offered incentives in the form of vouchers totalling 600 €, including one voucher of 300 €, one of 200 € and one of 100 €, and personalized feedback on participants’ self-control.

The final sample of N = 1,063 consisted of 696 participants who identified as female (65.5 %), 354 identifying as male (33.3 %), and 13 (1.2 %) identifying as diverse. The average age was 35.89 years (SD = 13.15), with a median age of 33 years and a range from 18 to 76 years. The data on employment are summarized in Table 1.

Table 1

Distribution of Job Status

Job Status	Absolute Frequency	Relative Frequency
Student	435	41 %
Employed	667	63 %
Self-employed	107	10 %
Job-seeking	55	5 %
Housewife/Househusband	15	1 %
Retired	41	4 %
Unable to work	20	2 %
Other: [Free text]	36	3 %

Note. Multiple responses were allowed, resulting in an absolute number of responses exceeding $N = 1063$. Relative frequency is calculated based on the sample size.

Procedure

The study began with a description of the procedure and obtaining of consent. Following, proficiency in the German language was assessed to immediately exclude participants without sufficient skills. Then, the SCSS was presented, based on the original procedure (Katzir et al., 2021). To ensure high data quality, three attention check items were implemented at fixed points, while the remaining 38 items were presented in random order. In the next step, the Pure Procrastination Scale *(PPS)* (Steel, 2010), screen time and additional scales which are not relevant for this thesis were administered.

Once the actual study had been completed, the demographic data was collected (gender, age and occupational status). The questionnaire consisted of a total of 110 items. To take part in the lottery, there was an option at the end to enter an email address.

Measures

The complete scales and questionnaires used are available in German in Appendix A. Demographics, SCSS, PPS and screen time will be described below in more detail.

Demographics. Participants were requested to provide information on their age (in years), best identified gender (female, male, other), proficiency in the German language (native, fluent, good, not so good) and occupational status (student, employed, self-employed,

job-seeking, housewife/househusband, retired, unable to work, other). Multiple responses were possible for occupational status.

Self-Control Strategy Scale (SCSS). To assess the engagement in *self-control strategies,* we used the German version of the SCSS by Katzir et al. (2021) as translated by Roth et al. (2023) which includes 38 items, 5 of which are reverse coded (1 = *not at all*, 5 = *very much*). Example items and α-values for each strategy are listed in Table 2.

Pure Procrastination Scale (PPS). To assess procrastination tendencies, the 12-item long Pure Procrastination Scale (*PPS*; Steel, 2010) was administered ('In preparation for some deadlines, I often waste time by doing other things', 1 = *strongly disagree*, 7 = *strongly agree*, α = .93). We used the validated German version (Svartdal et al., 2016).

Table 2

Example Items of each Strategy of the SCSS

Strategy	Example Item	α
Situation Selection	*I alter my environment so that I will not face temptations.*	.87
Punishment	*To make sure that I realise my plans and goals successfully, I impose sanctions on myself.*	.71
Reward	*I usually reward myself for accomplishing my long-term goals.*	.93
Pre-Commitment	*I commit myself in advance to goals I want to achieve (e.g., by committing to deadlines, by paying money in advance to activities I want to participate in).*	.56
Distraction	*When I face a temptation, I want to resist, I distract myself from it.*	.86
Cognitive Change	*When I face an unwanted desire, I control myself by changing the way I think about it.*	.78
Acceptance	*When I want to feel less craving from a temptation I accept my cravings.*	.75
Behavioural Inhibition	*When I face a temptation there is a high likelihood I will resist it.*	.89

Note. The α values were calculated from the sample of this study.

Screen time. Mobile phone use was operationalized through screen time for an economic and objective measure. Participants were requested to indicate their average phone screen time as recorded by their phone. They were asked to report the daily average over the preceding week or day, whichever statistic was available in full on their mobile phone. Respondents had the choice to indicate if they were unable or unwilling to answer this item.

Data Cleaning and Analysis

The data was cleaned and analysed using R (4.3.1) and RStudio (2023.06.2) based on predefined standards by Roth et al. (2023): during this, incomplete data sets and those that met the exclusion criteria were excluded. The final dataset comprised 1,324 complete surveys, meaning participants provided consent and fully completed the questionnaire, with missing values only permitted for screen time. Besides incomplete participation, exclusion criteria included insufficient knowledge of the German language, too rapid participation (beyond three standard deviations from the mean), failure to correctly answer all attention check items, and previous completion of the SCSS. No participants were excluded for rapid participation, three were excluded for prior completion of the SCSS, and 256 observations due to inadequate language skills or failed attention checks, with these two often overlapping. This resulted in effective N = 1,063 for regression analysis. To perform the mediation analysis, 458 additional surveys were excluded because of missing screen time data, leading to an effective sample size of N = 605 for the mediation.

Then, variables such as attention checks that were not relevant for the analysis were filtered out. Reversed items were recoded. The mean values and standard deviations for scales and subscales were calculated and the demographic data of the sample was analysed. To wrap up the descriptive analysis of the data, a correlation matrix was created with the combination of SCSS subscales and PPS data with age. To test the reliability of both scales, α was computed for the PPS and for each subscale of the SCSS.

Requirements for multiple regression analysis and mediation analysis were tested or assumed. Regarding the mediation analysis, the assumptions were tested for multiple regressions for both path *a* (predictors to mediator) and paths *b* and *c* (predictors and mediator to outcome). All requirements were met. The corresponding graphs can be found in Appendix C. Then a multiple regression was conducted to assess the relationship of each *strategy* with *procrastination* while controlling for all other *strategies* and to test hypotheses H1a-h. To test H2a-h, the mediation analysis was conducted using the ‘meditation’ package

in RStudio, according to the research model seen in Figure 1. As the last step, exploratory analyses were conducted to gain a deeper understanding of the results. These analyses are explained below in more detail.

Results

Descriptive Analyses

Before conducting the main analyses, I calculated means, standard deviations, Cronbach's α to assess internal consistency (Cronbach, 1951) as well as a correlational matrix for screen time, the PPS, and all SCSS subscales to gain a first overview of the data and screen for any unexpected outcomes, as summarized in Table 3:

All α-values exceeded the common threshold of a minimum of $\alpha > .70$ (Tavakol & Dennick, 2011), except *pre-commitment* ($\alpha = .56$).

Most SCSS subscales exhibited significant, positive relationships with each other. This indicates that the more a person uses one strategy, the more likely they are to use the others, consistent with findings by Katzir et al. (2021). The only exception was *acceptance* which correlated negatively with *situation selection*, *punishment*, *pre-commitment*, and *distraction*.

As anticipated (e.g., Katzir et al., 2021; Kim et al., 2017; Steel, 2007), *procrastination* showed a significant negative correlation with all *strategies*. The only exception was *punishment*. Screen time had a significant negative association with the strategies *cognitive change* and *inhibition* and was additionally positively associated with *procrastination*, as expected (Przepiorka et al., 2016). Consistent with previous studies, age demonstrated a significant negative correlation with both *procrastination* (Steel & Ferrari, 2013; Svartdal et al., 2016) and screen time (Olson et al., 2022).

Table 3

Mean, Standard Deviation and Cronbach's α of all Scales and Subscales and Correlation Matrix with Confidence Intervals

Variable	M	SD	α	1	2	3	4	5	6	7	8	9	10
1. Sit. selection	2.81	0.94	.87										
2. Punishment	2.46	0.92	.71	.32** [.27, .37]									
3. Reward	3.62	1.20	.93	.11** [.05, .17]	.29** [.23, .34]								
4. Pre-Commitment	3.32	0.86	.56	.23** [.18, .29]	.37** [.32, .42]	.35** [.29, .40]							
5. Distraction	3.31	0.87	.86	.31** [.25, .36]	.24** [.18, .29]	.27** [.22, .33]	.31** [.25, .36]						
6. Cog. Change	3.13	0.84	.78	.22** [.17, .28]	.15** [.09, .21]	.23** [.18, .29]	.26** [.21, .32]	.40** [.34, .44]					
7. Acceptance	3.69	0.88	.75	-.14** [-.20, -.08]	-.26** [-.32, -.20]	.06* [.00, .12]	-.01 [-.07, .05]	-.10** [-.16, -.04]	.20** [.14, .25]				
8. Beh. Inhibition	2.94	0.95	.89	.09** [.03, .15]	.02 [-.04, .08]	.10** [.04, .16]	.25** [.19, .30]	.21** [.15, .27]	.46** [.41, .51]	.20** [.14, .25]			
9. Procrastination	2.77	0.91	.93	-.08** [-.14, -.02]	-.00 [-.06, .06]	-.11** [-.17, -.05]	-.25** [-.31, -.20]	-.20** [-.26, -.14]	-.31** [-.36, -.25]	-.15** [-.21, -.10]	-.56** [-.60, -.51]		
10. Screen time	341.11	167.39		-.05 [-.13, .03]	.03 [-.05, .11]	.04 [-.04, .12]	-.03 [-.11, .05]	-.06 [-.14, .02]	-.14** [-.22, -.06]	-.03 [-.11, .05]	-.11** [-.19, -.03]	.20** [.13, .28]	
11. Age	35.89	13.15		-.04 [-.10, .02]	-.20** [-.26, -.15]	-.04 [-.10, .02]	-.09** [-.15, -.03]	.01 [-.05, .07]	-.01 [-.07, .05]	.22** [.16, .28]	.07* [.01, .13]	-.28** [-.33, -.22]	-.14** [-.22, -.06]

Note. Average screen time is reported in minutes per day. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * $p < .05$, ** $p < .01$.

Hypothesis Testing and Exploratory Analyses

Hypothesis 1 a - h

Hypotheses 1 a-h proposed a negative relationship between the *self-control strategies* and *procrastination*. I anticipated that each *self-control strategy* would significantly predict lower *procrastination* while controlling for the influence of all other *self-control strategies*.

The findings from the multiple regression analysis provided partial support for these hypotheses. More specifically, *pre-commitment* (β = -.13, $t(1054) = -4.28$, $p < .001$), *distraction* (β = -0.062, $t(1054) = -2.09$, $p = .037$), and *behavioural inhibition* (β = -.49, $t(1054) = -16.90$, $p < .001$) were all significant predictors of lower *procrastination*. In contrast with these associations and contrary to the corresponding hypothesis, *punishment* was found to have a significant positive association with *procrastination* (β = .072, $t(1054) = 2.41$, $p = .016$). The other strategies—*situation selection*, *reward*, *acceptance*, and *cognitive change*—did not significantly predict *procrastination* when controlling for the other strategies.

Among the predictors, *behavioural inhibition* and *pre-commitment* emerged as the most relevant, with a medium-to-large effect size and small effect size (Cohen, 1988). The effects of those two predictors on *procrastination* are visualized in Figures 2 and 3. All other predictors had very small effect sizes (β < .1), indicating a relatively small relevance when controlling for all other strategies. Detailed β-values, significance, and confidence intervals for all predictors are presented in Table 4.

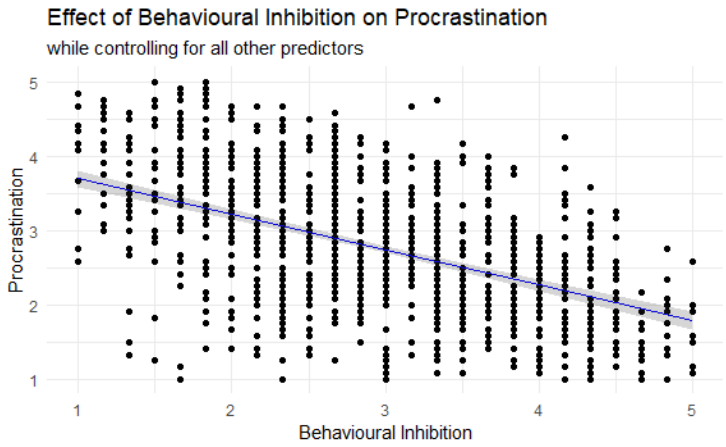

Figure 2. Effect of behavioural inhibition on procrastination

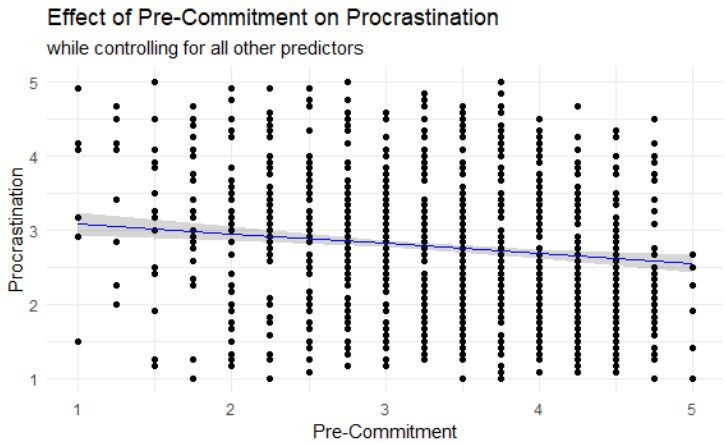

Figure 3. Effect of pre-commitment on procrastination

The regression model incorporating all eight predictors explained approximately 33% of the variance in *procrastination* (adjusted R^2 = .328, p <.001). The adjusted R^2 accounts for the number of predictors in the model and is meant to prevent overestimations of the effect size at the population level (Döring & Bortz, 2016).

Exploratory Analyses for Hypothesis 1 a - h

To further explore the underlying mechanisms, two exploratory analyses were conducted.

Similar to previous studies (Steel & Ferrari, 2013; Svartdal et al., 2016), age was a significant predictor of *procrastination* (β = -.28, p <.001). Therefore, age was included as a covariate. Subsequently, *pre-commitment* (β = -.14, t(1053) = -4.98, p <.001), *behavioural inhibition* (β = -.48, t(1053) = -17.11, p <.001) and age (β = -.25, t(1053) = -10.02, p <.001), significantly predicted *procrastination*. The adapted β-values, significance and confidence intervals can also be found in Table 4.

The regression model that included all eight *self-control strategies* and age explained circa 39% of the variance in *procrastination* (adjusted R^2 = .386, p <.001).

This represents a 6% increase in explained variance compared to the model with only the eight strategies, underscoring the significance of age as a predictor of *procrastination*.

Table 4

Results of the Multiple Linear Regression for H 1 a - h and Exploratory Analyses

	With all eight strategies		**With age as covariate**		**Without inhibition**	
Predictor	**β**	**Standardized CI**	**β**	**Standardized CI**	**β**	**Standardized CI**
Intercept	.00	-.05 – .05	.00	-.05 – .05	.00	-.06 – .06
Situation selection	-.01	-.07 – .04	-.01	-.06 – .05	-.01	-.07 – .06
Punishment	.07*	.01 – .13	-.03	-.02 – .09	.10**	.04 – .17
Reward	-.01	-.07 – .04	-.02	-.07 – .04	.02	-.05 – .08
Pre-commitment	-.13***	-.18 – -.07	-.14***	-.20 – -.09	-.21***	-.28 – -.15
Distraction	-.06*	-.12 – -.00	-.04	-.09 – .02	-.08*	-.15 – -.02
Cognitive change	-.02	-.08 – .04	-.04	-.10 – .02	-.22***	-.28 – -.15
Acceptance	-.04	-.10 – .01	.01	-.05 – .06	-.10**	-.16 – -.04
Behavioural inhibition	-.49***	-.55 – -.43	-.48***	-.53 – -.42	-	-
Age	-	-	-.25***	-.30 – -.20	-	-
	F-Statistic	**Adjusted R^2**	**F-Statistic**	**Adjusted R^2**	**F-Statistic**	**Adjusted R^2**
Comprehensive Model	65.74	.328***	75.11	.386***	27.02	.146***

Note. Multiple linear regression with corresponding predictors while controlling for all other predictors and a sample size of $N = 1063$.

* $p < .05$. ** $p < .01$, *** $p < .001$.

The second exploratory analysis was based on the phrasing of the *behavioural inhibition* items. Unlike the items for other *strategies*, these items not only asked whether a strategy is used but also how easy one finds it to implement or how successful one is in doing so. For instance, one item states, '*I usually manage to control myself from acting on unwanted desires even if they are tempting*.', in contrast to this example item on *cognitive change* '*When I encounter a temptation, I think about it in a different light*.' which is focused on whether one applies the strategy, rather than how good someone is at it.

Now given that the *inhibition* items measure not only the use of the strategy but also its success, I repeated the analyses without these items to account for the confounding effect with self-control success. The results were as follows: *punishment* ($\beta = .10$, $t(1055) = 3.13$, $p = .002$), *pre-commitment* ($\beta = -.21$, $t(1055) = -6.55$, $p < .001$), *distraction* ($\beta = -.08$, $t(1055) = -2.54$, $p = .011$), *cognitive change* ($\beta = -.22$, $t = -6.66$, $p < .001$), and *acceptance* ($\beta = -.01$, $t(1055) = -3.12$, $p = .002$) significantly predicted *procrastination*. The explained variance for this model was circa 15 % (Adjusted $R^2 = .146$, $p < .001$), which was still highly significant but a lot less explained variance than the model that included *inhibition*.

Hypothesis 2 a - h

Hypotheses 2 a-h posited that screen time mediates the relationship between each individual *self-control strategy* and *procrastination* while controlling for all other *self-control strategies*. To test these hypotheses, a mediation analysis with eight predictors was performed using the 'mediation' package in RStudio, which employs the quasi-Bayesian Monte Carlo method for estimating the Average Causal Mediation Effect (Tingley et al., 2014). I utilized bootstrapping with 1000 iterations and heteroskedasticity-consistent standard errors (Davidson & MacKinnon, 1993). Each path coefficient was estimated while controlling for all other predictors and standardized. Path *a* signifies the path from the predictors to the mediator, path *b* signifies the path from the mediator to the outcome while controlling for the predictors, *a*b* signifies the indirect effect of the predictors through the mediator, path *c'* signifies the direct effect of the predictor on the outcome. The total effect *c* of the predictors is consequently the sum of direct and indirect effect *a*b+c*. The standardized indirect effect is used as effect size (Rucker et al., 2011). Path *a*, *c'* and the indirect effect for each predictor are depicted in Table 5, path $b = 0.13$ for this analysis.

Contrary to the original paper by Baron and Kenny (1986), which required the significance of all paths to interpret a mediation effect, more recent studies suggest that significant indirect path coefficients *a* and *b* and a significant indirect effect (*ab*) provide

sufficient evidence for mediation (MacKinnon, 2008; Rucker et al., 2011; Zhao et al., 2010). Following these updated guidelines, significant indirect effects were considered indicative of mediation.

Consequently, the findings from the mediation analysis provided partial support for hypotheses 2a-h. Specifically, the relationship between *cognitive change* and *procrastination* was mediated by screen time (a = -0.12, b = 0.13, ab = -0.02, p = 0.02). This indirect-only or full mediation is indicated by the absence of a significant direct effect (c' = -0.01, p = 0.70) while the indirect effect was significant (Baron & Kenny, 1986; Zhao et al., 2010). According to Cohen's (1988) conventions, the effect size (ab = -0.02) is considered very small.

Exploratory Analyses for Hypothesis 2 a – h

As discussed above, age was a significant predictor of *procrastination*. As age was also a significant predictor of screen time (β = -0.14, p <.001), it was included again as a covariate in the analysis. The relationship between *cognitive change* and *procrastination* remained fully mediated by screen time (a = -0.14, b = 0.10, ab = -0.01, p = 0.006), indicating a very small, but stable effect.

Similarly, when excluding *behavioural inhibition* in a second exploratory analysis, the relationship between *cognitive change* and *procrastination* remained mediated by screen time (a = -0.15, b = 0.15, ab = -0.02, p = 0.006), again a very small but stable effect. Additionally, both the direct and total effect were now significant (c = −0.23, c' = -.21, p <.001). This can be classified as complementary or partial mediation, as both an indirect effect and a direct effect were present and pointed in the same direction (Baron & Kenny, 1986; Zhao et al., 2010). All paths *a, c'* and *ab* are depicted in Table 5.

Table 5

Results of the Mediation for H2a-h and Exploratory Analyses

	With all eight strategies			With age as covariate			Without inhibition		
Predictor	**a**	**c'**	**Indirect Effect**	**a**	**c'**	**Indirect Effect**	**a**	**c'**	**Indirect Effect**
Intercept	.00***	.00***	.00	.00***	.00***	.00	.00***	.00***	.00
Situation selection	-.04	-.03	-.01	-.02	-.01	-.00	-.05	-.03	-.01
Punishment	.06	.12**	.01	.03	.07*	.00	.07	.09	.01
Reward	.07	-.03	.01	.07	-.03	.01	.04	.02	.01
Pre-commitment	-.01	-.13**	-.00	-.02	-.14***	-.00	-.11	-.19***	-.02
Distraction	-.02	-.06	-.00	-.01	-.04	-.00	.03	-.12*	.01
Cognitive change	-.12*	-.01	-.02*	-.14**	-.04	-.01**	-.15*	-.21***	-.02**
Acceptance	.01	-.01	.00	.03	.03	.00	.02	-.03	.00
Behavioural inhibition	-.05	-.50***	-.01	-.04	-.49***	-.00	-	-	-
Age	-	-	-	-.14**	-.22***	-.01**	-	-	-

Note. Mediation analyses with corresponding predictors while controlling for all other predictors and a sample size of $N = 605$. All path coefficients are standardized and estimated while controlling for all other predictors, path *a* signifies the path from the predictors to the mediator, path *b* signifies the path from the mediator to the outcome while controlling for the predictors (can be found in the text), *a*b* signifies the indirect effect through the mediator, path *c'* signifies the direct effect of the predictor on the outcome, total effect *c* of the predictors is consequently *a*b+c* (not depicted), the standardized indirect effect *a*b* is used as effect size (Rucker et al., 2011).

* $p < .05$. ** $p < .01$, *** $p < .001$.

Discussion

Summary

The aim of this study was to gain a deeper understanding of the predictors of *procrastination*, focusing specifically on *self-control strategies* and screen time. It investigated the buffering effect of *self-control strategies* on *procrastination*, as opposed to prior studies that focused on *self-control* defined as *inhibition* and examined how screen time mediates this relationship as a prevalent behaviour that may hinder working towards one's goals. The results indicated that *behavioural inhibition*, *distraction*, and *pre-commitment* significantly predicted lower levels of *procrastination* when controlling for other strategies, while *punishment* significantly predicted higher levels of *procrastination*. When screen time was included as a mediator, the relationship between *cognitive change* and *procrastination* was fully and significantly mediated by screen time.

Interpretation of Results

Hypothesis 1 proposed that increased use of each *self-control strategy*, while controlling for the use of all other *strategies*, is associated with lower *procrastination*. The findings partially supported this hypothesis. Although all strategies except *punishment* showed significant simple correlations with *procrastination*, only four *self-control strategies* emerged as significant predictors when accounting for the use of all other strategies. Specifically, *behavioural inhibition*, *distraction*, and *pre-commitment* were found to significantly predict lower levels of *procrastination* when controlling for other strategies. This suggests that employing these adaptive strategies can help reduce *procrastination* tendencies. On the contrary, *punishment* was found to significantly predict higher levels of *procrastination*, indicating that this strategy may be maladaptive for decreasing *procrastination*.

The fact that some significant associations differ between the correlation and regression suggests overlaps in variance or the presence of mediating or suppressing effects (Cohen et al., 2003): s*ituation selection*, *acceptance*, and *cognitive change* might be mediated by one or multiple other strategies. Possible mediators for *situation selection* include *punishment* (r = .32) or *distraction* (r = .31), given that they are the strongest correlators of *situation selection*. *Punishment* may also serve as a mediator for the effect of *acceptance* (r = -.26). Mechanisms for cognitive change will be discussed in more detail below.

Punishment, however, did not show a significant simple correlation but did exhibit a significant positive association with *procrastination* in the regression analysis. This indicates

a suppressor effect from one or more of the other strategies (possibly *pre-commitment, r* = .37), as the maladaptive effect of *punishment* only becomes evident when controlling for the effects of the other strategies.

These multiple regression results align closely with those of Katzir et al. (2021), who investigated *self-control strategies* as predictors of self-control failure. Given that *procrastination* is often defined as a lack of *self-control* or self-regulation failure (Rozental & Carlbring, 2014; Schouwenburg, 2005; Steel, 2007), the findings are comparable. Katzir and colleagues (2021) found that *punishment* predicted higher self-control failure, while *pre-commitment* and *inhibition* predicted lower self-control failure. These patterns were also observed in this study, indicating further that *punishment* is a maladaptive strategy, while *pre-commitment* and *inhibition* are adaptive strategies for reducing procrastination, with *inhibition* emerging as the most important strategy in both studies. Additionally, *distraction* emerged as a significant predictor of lower *procrastination* in the present study. In line with Cumming's (2014) suggestion to prioritize effect sizes over mere significance, this difference in *distraction* should not be overinterpreted, as its effect size was very small (β = -.06).

The main difference between the present results and those of Katzir et al. (2021) is that they found *cognitive change* to be a significant predictor of higher self-control failure when controlling for all other strategies, indicating a positive association with self-control failure in their study. In this study, *cognitive change* was not a significant predictor of *procrastination* in the multiple regression analysis, although it had the second-highest simple correlation with *procrastination* (*r* = -.31), following *inhibition*.

This discrepancy with Katzir et al. (2021) could be attributed to differences in the analysed samples or to conceptual distinctions between *procrastination* and self-control failure as operationalized in their study. The difference between the simple correlations and regression results suggests that *cognitive change* may share a significant amount of variance with other *self-control strategies*, or that its effect is mediated by these strategies (Cohen et al., 2003). In particular, *inhibition* (*r* = .46) or *distraction* (*r* = .40) might mediate the effect of *cognitive change*, given their strong correlations with it. For example, the indirect effect of *cognitive change* via *inhibition* on *procrastination* would then suggest that when a person reinterprets the significance of a temptation or focuses on its negative consequences through *cognitive change*, they may become better at inhibiting themselves from giving in to the temptation. *Inhibition* then helps to reduce *procrastination* and help completing the task. In any case, contrary to the findings of Katzir et al. (2021), *cognitive change* would be an adaptive strategy in this study, as it is negatively correlated with *procrastination*.

This possible mediation of *cognitive change*'s impact by *inhibition* was further emphasized by the exploratory analysis that was conducted without *inhibition*, due to the potentially confounding effect of the phrasing of *behavioural inhibition* items as self-control success. Despite not being a significant predictor before, *cognitive change* emerged as the most important predictor of lower *procrastination* in this analysis, followed by *pre-commitment*, *acceptance*, and *distraction*, while *punishment* continued to show a maladaptive effect. Similarly, *acceptance* was not a significant predictor when *inhibition* was included in the analysis, suggesting that *behavioural inhibition* may mediate the relationship between these strategies and *procrastination*.

It is possible that *acceptance* and *cognitive change* particularly enhance *inhibition*, which in turn is reflected in successful self-control. Since both *acceptance* and *cognitive change* are strategies used in the 'later' phase of *down-regulation of temptation*, their use might also be perceived as effective inhibition.

When evaluating the impact of all strategies, *pre-commitment* and *inhibition* demonstrated the largest effect sizes. Their significance was further backed up when age was included as a covariate, with both strategies remaining highly significant predictors alongside age. When *inhibition* was excluded from the analysis, the effects of *punishment*, *pre-commitment*, and *distraction* increased, and *cognitive change* and *acceptance* became significant, with *cognitive change* and *pre-commitment* showing the largest effect sizes. These findings highlight the potentially underestimated importance of strategies beyond inhibition, as all these strategies exhibited at least a small effect size ($\beta > .10$).

In summary, there is heterogeneity in how strongly and in what way the different strategies were associated with *procrastination*. While most *self-control strategies* can prevent *procrastination*, some may foster it. This supports the proposal by Katzir and colleagues (2021) that interventions to increase *self-control* should be domain-specific: simply increasing all strategies might yield conflicting results or be simply inefficient. In the most economic manner, it appears that interventions should particularly focus on enhancing the use of *pre-commitment* and *inhibition* to reduce *procrastination*. The importance of these strategies was further underscored in exploratory analyses that included age as a variable. This suggests that the influence of these *self-control strategies* on *procrastination* is robust and independent of age, highlighting their potential importance in interventions aimed at reducing *procrastination* across different age groups. However, due to the changing associations when excluding *inhibition* and its possible confounding with self-control success, the exact role of *inhibition* remains uncertain and should be the subject of further

studies. Consequently and following the Process Model of Self-Control (Duckworth et al., 2016), it might also be beneficial to focus interventions on the earlier strategies as their effect appears to be at least partly mediated by inhibition or especially helpful to achieving successful inhibition.

The second hypothesis examined whether the relationship between *self-control strategies* and *procrastination* is mediated by screen time. It was hypothesized that the relationship between each *self-control strategy* and *procrastination* is mediated by screen time while controlling for all other strategies. This hypothesis was partly supported: the relationship between *cognitive change* and *procrastination* was mediated by screen time (indirect-only mediation). Specifically, *cognitive change* exhibited a negative relationship with screen time, meaning that higher use of cognitive change was associated with lower screen time. In turn, screen time had a positive relationship with *procrastination*, indicating that more screen time was associated with higher levels of *procrastination*. Thus, *cognitive change* had a significant effect in reducing *procrastination* through its negative association with screen time, even though there was no significant direct relationship between *cognitive change* and *procrastination*. Because this is an indirect-only mediation, the mediating of screen time fully accounts for the relationship between *cognitive change* and *procrastination*, indicating that no important mediator was left out (Zhao et al., 2010).

Including age as a covariate, the indirect effect of *cognitive change* on *procrastination* through screen time remained significant. This indicates that the mediating effect of screen time is consistent and robust across different age groups. The strong link between *cognitive change* and screen time may be due to cognitive change directly altering how a person views temptations like using their phone, making it less appealing or highlighting its negative consequences. It directly addresses how attractive or acceptable this temptation is perceived compared to the other strategies that appear to have a more direct effect on procrastination.

When excluding *inhibition* in the exploratory analysis, the mediation of *cognitive change* remained significant. However, the direct effect also became significant. According to Zhao et al. (2010), this is classified as complementary mediation and indicates the possible omission of additional mediators. Since the direct effect was not significant in the original analysis, the now omitted variable might be *inhibition* or self-control success. This suggests a need for future studies to further investigate the associations between *cognitive change* and *inhibition* and how they influence each other.

One aspect to discuss beside the results of the analyses is the composition of the sample. Since participants were recruited through social media advertisements, participation was inherently limited to individuals with social media accounts. This recruitment method might have contributed to a sample with higher mobile phone screen time (M = 5.68 hours, SD = 2.79 hours) compared to the general population averages (mean in Austria = 3 hours, mean in Germany = 3.42 hours; Statista, 2023). Similarly, the sample exhibited higher levels of *procrastination* (M = 2.77, SD = 0.91), compared to the German sample (M = 2.33, SD = 0.77) studied by Svartdal et al. (2016), a statistically significant difference ($p < .001$). Both samples are comparable in composition, including students and employees, with similar mean ages (M = 31.46 years by Svartdal et al., 2016; compared to M = 35.89). The observed difference could therefore be due to either general changes in procrastination behaviour over the last years or the specific recruitment method via social media. In either case, these findings are valuable, as they contribute more data on overall procrastination trends and highlight a potentially more vulnerable population which could be useful for developing targeted interventions. Potentially, there are also differences in the expression of *self-control strategies*, though we currently still lack data on the German-speaking population.

These differences should be considered when interpreting the results. While the recruitment method and sample composition are not limitations in the traditional sense, as it allowed for reaching a larger proportion of the population of interest, the results of the regression and mediation analyses may not be transferable to individuals without social media accounts. As procrastination is prevalent across most populations (Ferrari et al., 2005, 2007; Hen & Goroshit, 2018; Steel & Ferrari, 2013), individuals without social media may, therefore, engage in other types of behaviour as a channel to *procrastination*. They could replace the task completion with another, still adaptive but less urgent, activity such as cleaning the kitchen instead of going for that run which is commonly defined as *productive procrastination* (Westgate et al., 2017). They might also engage in behaviours involving other types of screen time, such as watching a series or playing video games, as these activities are also strongly associated with *procrastination* (Gökalp et al., 2023).

Limitations

The study design introduces certain limitations in the way the relationship between *self-control strategies*, *procrastination*, and screen time was evaluated. Given the cross-sectional, non-experimental nature of the design, it is not possible to ensure causal relationships. Consequently, the results of mediation analysis, which assumes causality, must be interpreted with caution.

Concerning the model specification, it is important to note that a mediator is typically defined as a process variable through which an effect occurs (Baron & Kenny, 1986). Given that Facebook is often used as a tool for *procrastination* (Meier et al., 2016) and drawing on previous study designs (e.g., Gökalp et al., 2023; Yang et al., 2019), the assumed model was suitable for an initial exploration of the research question. However, as Meier et al. (2016) point out, excessive media use might also be a result of *procrastination*. Consequently, the model might be better represented with *procrastination* as the predictor, screen time as the outcome, and *self-control strategies* as the mediator. Further research should address this issue and explore alternative model specifications. Additionally, future studies should include *trait self-control* into the model, as the effectiveness of *self-control strategies* appears to be moderated by *trait self-control* (Hennecke et al., 2019).

The exclusive use of self-report measures poses the problem of biased answers. Although the PPS significantly predicts real-life *procrastination* behaviour (Zuber et al., 2020) and *procrastination* scores were higher than in previous studies (e.g. Svartdal et al., 2016), participants may have been inclined to answer in a socially desirable manner. Particularly regarding the SCSS, we cannot be certain, as the predictive validity of the German SCSS has not yet been assessed. To minimise the risk, the data was collected anonymously.

How screen time was collected is another limitation. We exclusively assessed the objective amount of time participants spent on their phones. They were not asked what the contents of that time were, whether they were reading a book, watching a video for a course, or scrolling through social media. Furthermore, mobile phone usage is only part of the daily screen time. Participants could, for example, spend all their time on a tablet or computer. This was not considered by the study to collect the data economically. It is important for future research to differentiate precisely here and to record screen time in a more nuanced way. This could also include the psychological aspect such as problematic mobile phone use (e.g., Çebi et al., 2019) or screen addiction (Balhara et al., 2018a) for an even more refined assessment.

Contributions

Circling back to the introductory example of someone who aims to build stamina through running but instead procrastinates by scrolling through social media for immediate gratification, it becomes evident that interventions to prevent *procrastination* are highly important. Given the numerous negative life outcomes linked to *procrastination*, including poorer physical and mental health, higher stress, and lower life satisfaction (Beutel et al., 2016; Sirois et al., 2003), interventions that reliably improve *self-control*, addressing one of the root causes of *procrastination*, are highly valuable for society. However, such interventions often yield very small effects (Friese et al., 2017). This study showed that not only *trait self-control* is highly associated with *procrastination*, but so is the use of *self-control strategies*. Consequently, interventions focused on *self-control strategies* could be more effective and economical in preventing the negative implications of *procrastination* as they can be employed in a domain-specific, selective and practical manner (Katzir et al., 2021). This is especially promising because *trait self-control* and *self-control strategies* are distinct methods for achieving effective self-regulation and the strategic application of specific techniques can significantly enhance the effectiveness of *self-control* abilities (Hennecke et al., 2019). In addition, the *strategies* besides traditional *inhibition* target earlier points in the Process Model of Self-Control (Duckworth et al., 2016) and can therefore have a preventative effect.

While multiple studies (e.g., Gökalp et al., 2023; Yang et al., 2019) have incorporated problematic phone use as a mediator of the relationship between *self-control strategies* and *procrastination*, this study focused on an objective measure of mobile phone screen time to broaden the scope and provide a more comprehensive understanding of the effect. This focus is particularly relevant due to the increasing prevalence of media and mobile phone use to avoid tasks (David et al., 2015; Yildiz Durak & Saritepeci, 2019).

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Abstract (English)

Procrastination, the voluntary but potentially detrimental postponement of tasks, is associated with poorer physical and mental health, higher stress, and lower life satisfaction. Previous studies have identified self-control, defined as pursuing long-term goals despite competing short-term goals and as behavioural inhibition, as a predictor of lower procrastination. However, recent studies suggest that self-control extends beyond inhibition to include various other strategies, such as distraction or punishment. Subsequently, the present work aimed to investigate the influence of self-control strategies on procrastination. The second aim was to examine the impact of actions people take when they lack the self-control to follow through with their plans on the relationship with procrastination via mediation analysis. The chosen behaviour, screen time, which is strongly associated with both self-control and procrastination, is increasingly being used as a means to avoid working on tasks. A sample of 1,063 participants from the German-speaking general population was recruited through paid social media advertisements. Participants completed an online questionnaire that included the Self-Control Strategy Scale and the Pure Procrastination Scale and reported their average mobile phone screen time as documented by their phone. Results from multiple regression analyses indicated that behavioural inhibition, pre-commitment, and distraction were predictors of lower procrastination when controlling for all other strategies, while punishment significantly predicted higher procrastination. When including screen time as a mediator, the relationship between cognitive change and procrastination was fully mediated. These findings highlight the relevance of self-control strategies in understanding procrastination tendencies and suggest their implementation in interventions tackling procrastination.

Keywords: Procrastination, Self-Control Strategies, Screen Time

Abstract (Deutsch)

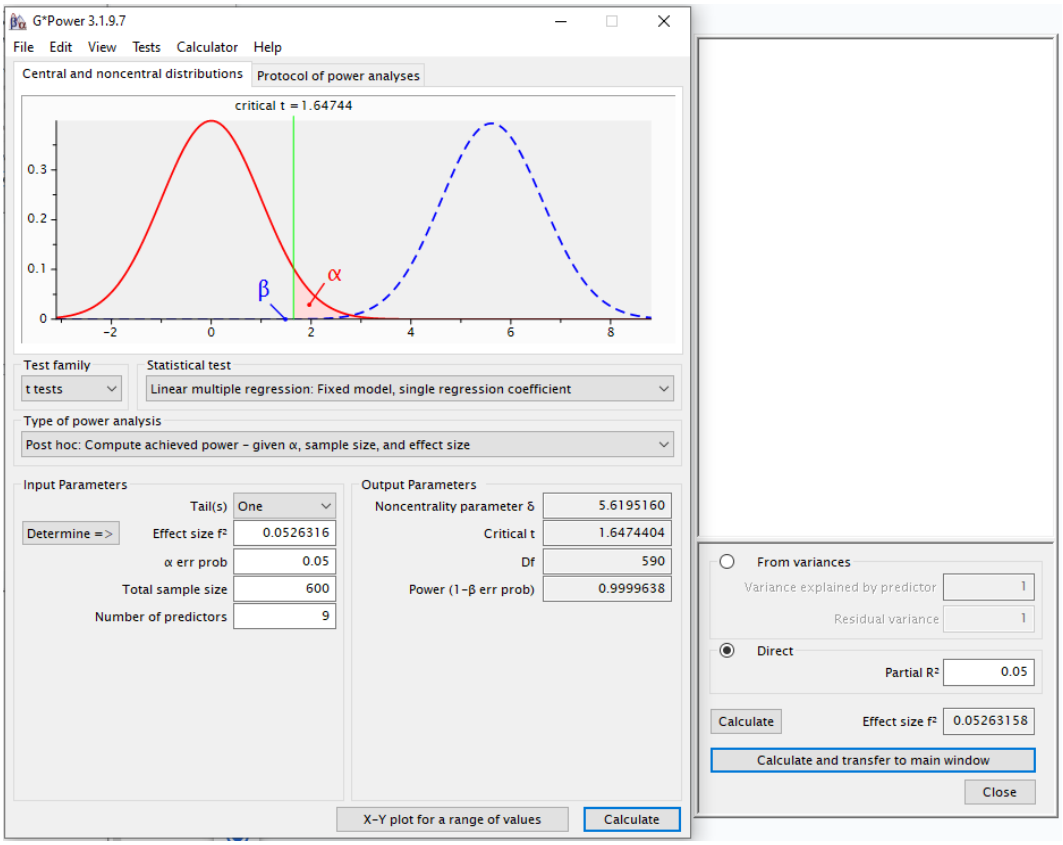
Prokrastination, das freiwillige, aber potenziell schädliche Aufschieben von Aufgaben, steht in Verbindung mit schlechterer körperlicher und geistiger Gesundheit, höherem Stress und geringerer Lebenszufriedenheit. Frühere Studien haben Selbstkontrolle, definiert als das Verfolgen langfristiger Ziele trotz konkurrierender kurzfristiger Interessen und hauptsächlich verstanden als Verhaltenshemmung, als Prädiktor für geringere Prokrastination identifiziert. Aktuelle Studien legen jedoch nahe, dass Selbstkontrolle über die Verhaltensinhibition hinausgeht und verschiedene andere Strategien wie Ablenkung oder Bestrafung umfasst. Das erste Ziel der vorliegenden Arbeit war es daher, den Einfluss von Selbstkontrollstrategien auf Prokrastination zu untersuchen. Das zweite Ziel beschäftigte sich mit Bildschirmzeit, welche sowohl mit Selbstkontrolle als auch mit Prokrastination hoch korreliert und zunehmend als Mittel zur Prokrastination genutzt wird. Mittels Mediation wurde untersucht, wie diese Verhaltensweisen, die Menschen wählen, wenn ihnen die Selbstkontrolle zur Verfolgung ihrer Ziele fehlt, die Assoziation zwischen Selbstkontrollstrategien und Prokrastination beeinflussen. Eine Stichprobe von 1063 Teilnehmenden aus der deutschsprachigen Allgemeinbevölkerung wurde durch Social-Media-Werbung rekrutiert. Die Teilnehmenden füllten einen Online-Fragebogen aus, der sowohl die Self-Control Strategy Scale als auch die Pure Procrastination Scale beinhaltete, und gaben zur objektiven Messung die Statistik ihrer täglichen Handybildschirmzeit an. Die Ergebnisse der multiplen Regressionsanalysen zeigten, dass Verhaltenshemmung, Vorabverpflichtung und Ablenkung signifikante Prädiktoren für eine geringere Prokrastination waren, wenn für die anderen Strategien kontrolliert wurde, während Bestrafung mit höherer Prokrastination assoziiert war. Wurde Bildschirmzeit als Mediator einbezogen, wurde der Zusammenhang zwischen kognitiver Veränderung und Prokrastination vollständig mediiert. Diese Ergebnisse unterstreichen die Relevanz von Selbstkontrollstrategien beim Verständnis von Prokrastinationstendenzen und legen ihre Implementierung in Interventionen nahe.

Keywords: Prokrastination, Selbstkontrollstrategien, Bildschirmzeit

Appendix A

Power Analysis and Questionnaires

Power Analysis (G*Power 3.1.9.7, Faul et al., 2007)



Questionnaires

Additional to the following scales, step count, pro-environmental behaviour and goal importance of pro-environmental behaviour are assessed in this sample.

SCSS - German Version (Roth et al., 2023)

Der folgende Fragebogen wurde entwickelt, um Ihren Umgang mit Selbstkontrollkonflikten zu messen. Ein Selbstkontrollkonflikt kann entstehen, wenn…

- man **mit einer Versuchung konfrontiert wird**, während man versucht ein längerfristiges Ziel zu erreichen (z.B. Freund:innen wollen ausgehen, dabei will man eigentlich einen regelmäßigen Schlafrhythmus aufrechterhalten)
- man **etwas beginnen möchte, das einem widerstrebt**, um ein langfristiges Ziel zu erreichen (z.B. an einem kalten Abend laufen gehen, um gute Ausdauer anzutrainieren)
- man **bei etwas durchhalten will, das anstrengend ist**, um ein Ziel zu erreichen (z.B. einen langen Text lesen, um eine Prüfung zu bestehen)

Nicht jedes Verlangen ist eine Versuchung, sondern nur jene, die wir eigentlich ablehnen, weil sie in Konflikt mit etwas anderem stehen, das wir erledigen wollen (z.B. kann im vorherigen Beispiel auch das frühe zu Bett gehen eine Versuchung sein in Bezug auf das Ziel, seine sozialen Kontakte aufrecht zu erhalten).

Personen reagieren nicht immer gleich; das heißt man kann in einigen *situation*en sehr kontrolliert sein und in anderen Lebensbereichen weniger kontrolliert. Das kann das Beantworten mancher Fragen schwierig machen. Wir bitten Sie hier Ihre persönliche Tendenz über verschiedene Lebensbereiche hinweg anzugeben (z.B. Essen, Sex, Gesundheit, Arbeit, Studium, Kindererziehung, Dating, Shopping, Sparen, Alkohol- und / oder Tabakkonsum).

Zur Erinnerung: Ein Selbstkontrollkonflikt kann entstehen, wenn…

- man **mit einer Versuchung konfrontiert wird**, während man versucht ein längerfristiges Ziel zu erreichen (z.B. Freund:innen wollen ausgehen, dabei will man eigentlich einen regelmäßigen Schlafrhythmus aufrechterhalten)
- man **etwas beginnen möchte, das einem widerstrebt**, um ein langfristiges Ziel zu erreichen (z.B. an einem kalten Abend laufen gehen, um gute Ausdauer anzutrainieren)
- man bei **etwas durchhalten will, das anstrengend ist**, um ein Ziel zu erreichen (z.B. einen langen Text lesen, um eine Prüfung zu bestehen)

Item	Response Format
Wenn ich längerfristige Ziele verfolge, schließe ich gerne „Verträge mit mir selbst“ ab, die Belohnungen für Erfolg und Bestrafungen für Misserfolg enthalten.	Stimme gar nicht zu Stimme eher nicht zu Weder noch Stimme etwas zu Stimme voll und ganz zu
Ich verschreibe mich frühzeitig Zielen, die ich erreichen möchte (z.B. setzen von Deadlines, im Vorhinein Aktivitäten bezahlen, an denen ich teilnehmen möchte).	
Wenn ich mit einer Versuchung konfrontiert bin, konzentriere ich mich auf etwas anderes.	
Es fällt mir schwer, mein Verhalten zu kontrollieren, wenn ich einen unerwünschten Drang verspüre.	
Es fällt mir schwer, gewisse Dinge zu vermeiden, auch wenn sie schlecht für mich sind.	
Immer wenn ich den Drang spüre, etwas Unerlaubtes zu tun, akzeptiere ich, dass ich dieses Gefühl habe.	
Es fällt mir leicht, mich davon abzuhalten, unerwünschten Drängen nachzugeben.	
Ich bestrafe mich dafür, wenn ich „Verträge mit mir selbst“ breche.	
Um sicherzustellen, dass ich meine Pläne und Ziele erfolgreich umsetze, erlege ich mir selbst strenge Regeln auf.	
Ich organisiere mein Umfeld so, dass ich keine Versuchungen erlebe.	
Wenn ich einer Versuchung begegne, stehen die Chancen gut, dass ich dieser widerstehe.	
Wenn ich meine Ziele verfolge, belohne ich mich für meine Fortschritte.	
Wenn ich ein ungewolltes Verlangen erlebe, kontrolliere ich mich selbst, indem ich anders darüber nachdenke.	
Wenn ich versuche, ein wichtiges Ziel zu erreichen, gestalte ich mein Umfeld so, dass es frei von Versuchungen für mich ist.	

Wenn ich weniger Verlangen gegenüber einer Versuchung verspüren möchte, akzeptiere ich das Verlangen.
Wenn ich einer Versuchung begegne, denke ich über diese in einem anderen Licht nach.
Ich kann mich normalerweise davon abhalten, einem unerwünschten Drang nachzugeben, auch wenn dieser verlockend ist.
Wenn ich den Drang nach etwas habe, das nicht gut für mich ist, fällt es mir schwer, diesem zu widerstehen.
Wenn ich eine Versuchung spüre, akzeptiere ich mein Verlangen danach.
Ich organisiere mein Leben auf eine Art, durch die ich Versuchungen leichter vermeiden kann.
Ich setze mir selten Deadlines.
Wenn ich ein langfristiges Ziel erreicht habe, belohne ich mich.
Wenn ich mit einer Versuchung konfrontiert bin, lenke ich meine Aufmerksamkeit von dieser weg.
Ich distanziere mich von *situation*en, die Versuchungen beinhalten könnten.
Wenn mir ein ungewolltes Verlangen in den Kopf kommt, versuche ich an etwas anderes zu denken.
Ich erzähle Anderen von meinen langfristigen Zielen, um sichtbar zu machen, ob ich mich daran halte oder nicht.
Wenn ich mit einer Versuchung konfrontiert bin, der ich widerstehen möchte, lenke ich mich von dieser ab.
Ich passe meine Umgebung an, um keine Versuchungen zu erleben.
Wenn ich einer Versuchung begegne, denke ich auf eine Weise darüber nach, die mir hilft, weniger versucht zu sein.
Wenn ich mit einer Versuchung konfrontiert bin, denke ich an etwas anderes.
Wenn ich ein unerwünschtes Verlangen spüre, denke ich in einer kalten, unabhängigen und neutralen Art darüber nach.
Normalerweise bestrafe ich mich nicht dafür, falls ich einer Versuchung nachgegeben habe.

Wenn ich eine Versuchung weniger stark spüren möchte, ändere ich die Art und Weise, wie ich über die Versuchung nachdenke.	
Wenn ich mir ein längerfristiges Ziel setze, plane ich mich zu belohnen, wenn ich dieses erreiche.	
Wenn ich ein Ziel erreichen will, sorge ich durch Handlungen oder Einschränkungen dafür, dass es für mich kaum möglich ist, zu versagen.	
Ich belohne mich normalerweise für das Erreichen langfristiger Ziele.	
Ich suche *situation*en in meinem Leben so aus, dass ich keine Versuchungen erlebe.	
Auch wenn es Versuchungen gibt, über die ich lieber nicht nachdenken würde, akzeptiere ich meine Gedanken über die Versuchungen.	

Notes. The definition of a self-control conflict was presented on each page for reference. For each item, the response format was the same.

PPS - German Version (Svartdal et al., 2016)

Im zweiten Fragenblock geht es um Ihre persönliche Erfahrung mit Entscheidungen und dem Erfüllen von Aufgaben.
Im Folgenden finden Sie einige Aussagen, die Ihre Fähigkeit betreffen, Aufgaben zu Ende zu führen und Entscheidungen zu fällen. Bitte schätzen Sie ein, inwieweit diese Aussagen auf Sie persönlich zutreffen.

Item	Response Format
Selbst kleine Sachen, bei denen man sich nur hinsetzen und sie erledigen müsste, bleiben häufig für Tage liegen.	Trifft sehr selten oder nicht auf mich zu Trifft selten auf mich zu Trifft manchmal auf mich zu Trifft oft auch mich zu Trifft sehr oft auf mich zu
Ich schiebe Entscheidungen auf, bis es zu spät ist.	
Ich vergeude viel Zeit mit Kleinigkeiten, bevor ich eine endgültige Entscheidung treffe.	
Selbst wenn ich eine Entscheidung treffe, schiebe ich es auf, entsprechend zu handeln.	
Mir läuft oft die Zeit davon.	
Ich schaffe die Dinge nicht pünktlich.	
Ich ertappe mich häufig dabei, Aufgaben zu erledigen, die ich eigentlich schon vor Tagen tun wollte.	
Das Aufschieben von Dingen bis zur letzten Minute hat mich in der Vergangenheit Geld gekostet.	
Bei der Vorbereitung auf einen Abgabetermin vergeude ich häufig meine Zeit mit anderen Dingen.	
Ich bin nicht sehr gut darin, Fristen einzuhalten.	
Im Allgemeinen schiebe ich den Beginn von Arbeiten, die ich tun muss, auf.	
Ich sage dauernd: "Das mache ich morgen".	

Note. For each item, the response format was the same.

Screen Time (Roth et al., 2023)

Bitte öffnen Sie nun die Anzeige Ihrer Bildschirmzeit. Als nächstes bitten wir Sie um einige Angaben dazu sowie einen Screenshot der Daten.	
Item	**Response Format**
Bitte geben Sie als erstes an, ob Ihnen der Durchschnitt des letzten Monats, der letzten Woche oder des letzten Tages angezeigt wird. Wenn Ihnen mehrere davon angezeigt werden, wählen Sie bitte die längste verfügbare Zeitperiode aus. Ich berichte den Durchschnitt der/des letzten…	Monats Woche Tags
Bitte geben Sie jetzt an, wie viele Stunden und Minuten Sie im Durchschnitt pro Tag mit der Smartphonenutzung verbracht haben. Beziehen Sie sich dabei auf den letzten Monat, die letzte Woche bzw. den letzten Tag, so wie Sie es oben angegeben haben.	Stunden Minuten
Bitte geben Sie die Daten des letzten vollständigen Monats (bzw. Woche / Tag) an und nicht des laufenden Monats (bzw. Woche / aktueller Tag).	
Bitte laden Sie hier einen Screenshot der Anzeige Ihrer Bildschirmzeit hoch. (Schneiden Sie das Bild gerne so zu, dass keine Informationen außerhalb der Bildschirmzeit erkennbar sind.)	Upload-Feld für Datei

Note. Participants have the choice to skip these questions before the items on screen timeare presented, if they do not have access to the necessary information.

Sociodemographics

Für die Studie ist es wichtig, dass Sie die Instruktionen und Fragen gut verstehen.	
Item	**Response Format**
Bitte geben Sie daher an, auf welchem Niveau Sie Deutsch sprechen.	Muttersprache Fließend Gut Nicht sehr gut
Zum Schluss haben wir noch drei Fragen zu Ihrer Person.	
Item	**Response Format**
Wie alt sind Sie (in Jahren)?	[Ziffern]
Welchem Geschlecht fühlen Sie sich am ehesten zugehörig?	Männlich Weiblich divers
Wie definieren Sie Ihren derzeitigen Berufsstatus? (Mehrfachnennungen möglich)	Studierend Angestellt Selbstständig Arbeitssuchend Hausfrau*mann In Rente/Pension Arbeitsunfähig Sonstige: [Freitext]

Note. German language skills are assessed at the beginning of the questionnaire, gender, age, and occupational status at the end.

Appendix B

Social Media Sites and Flyers

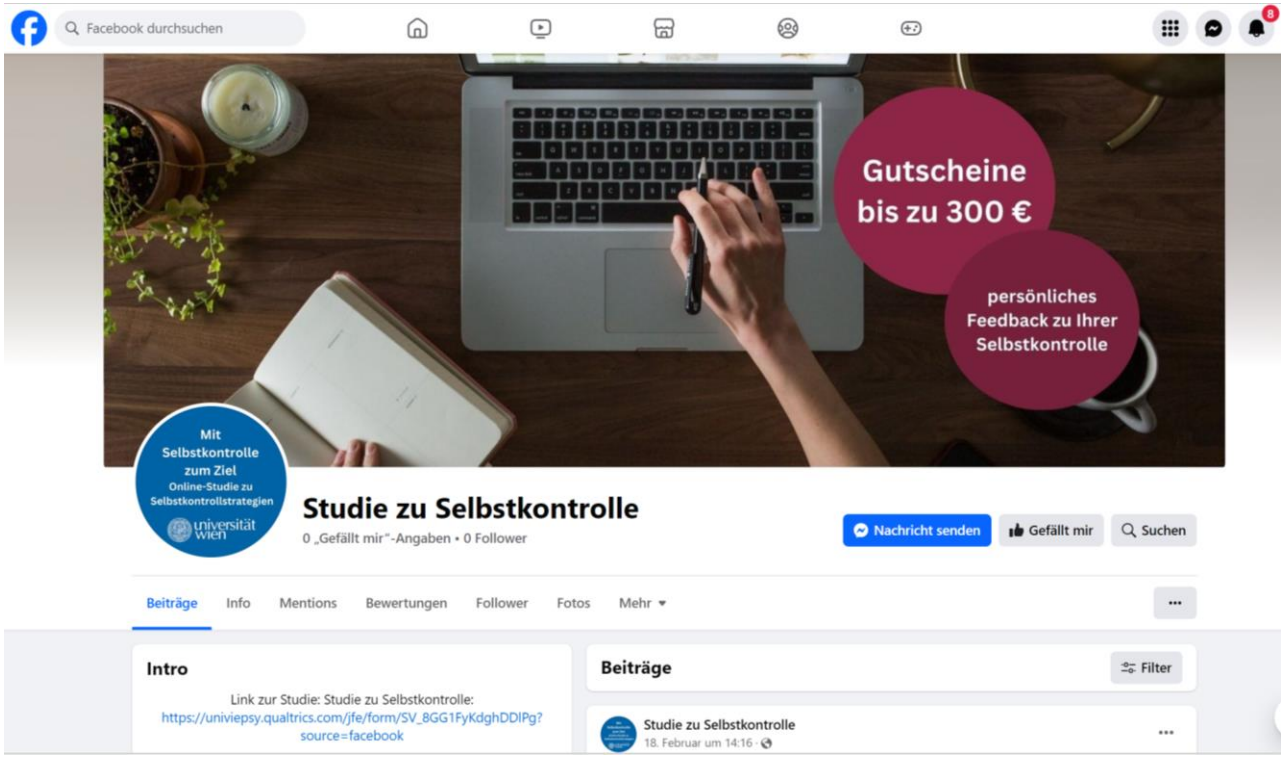
Version A of the Flyer (productivity theme)

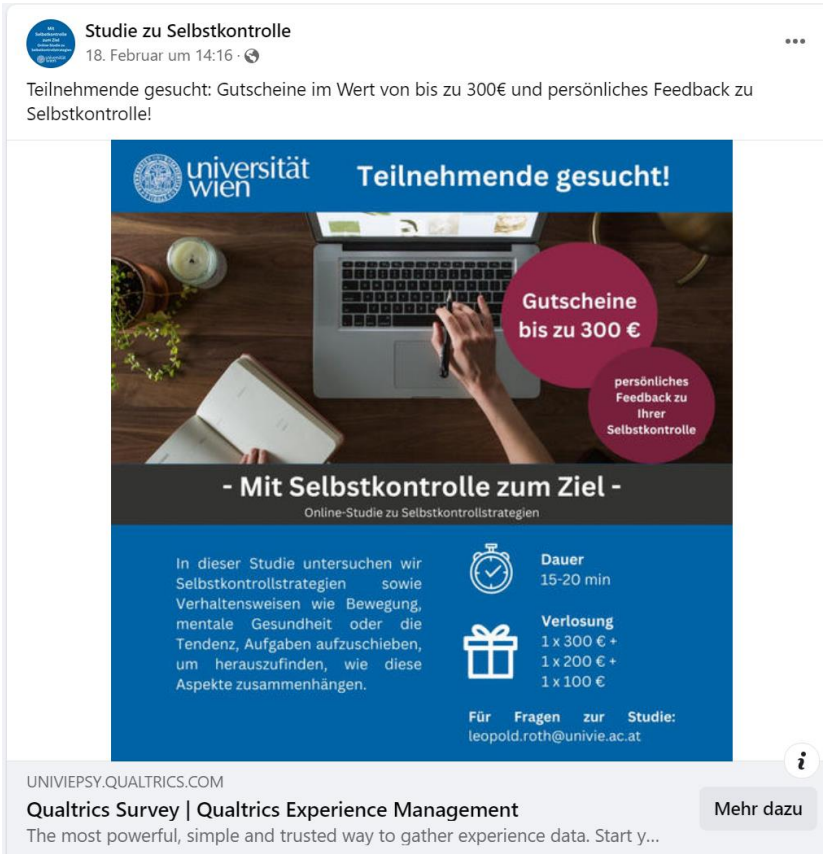
Version B of the Flyer (sports theme)

Version C of the Flyer (fitness theme)

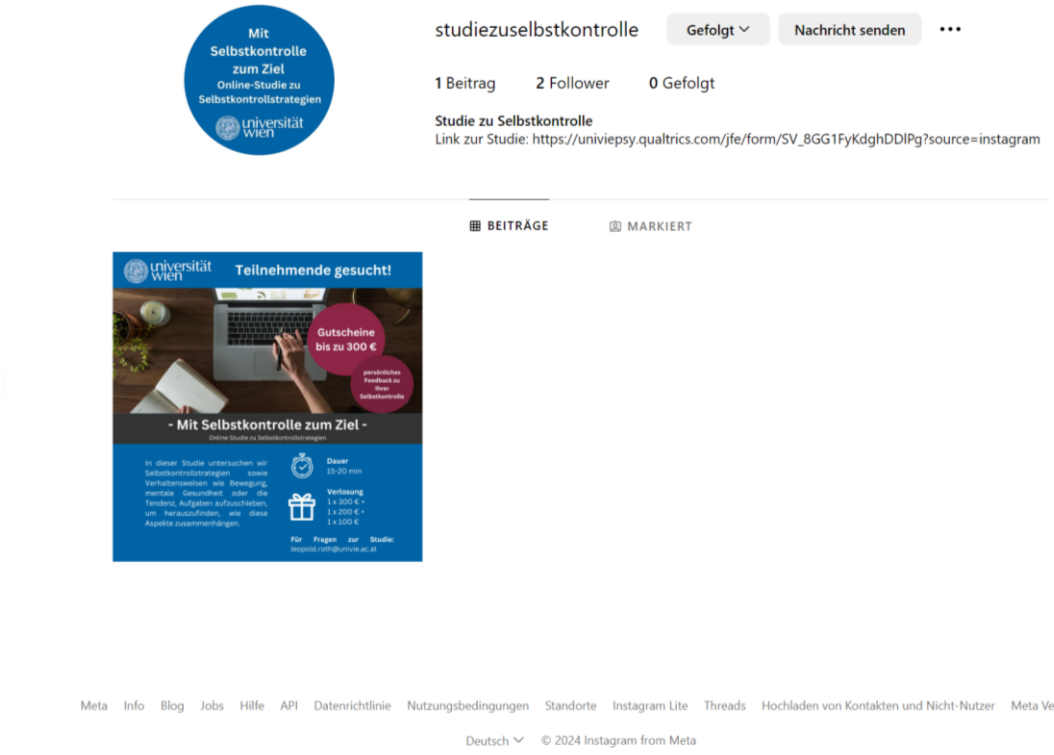
Version D of the Flyer (work theme)

Landing Page and Post of Facebook Account ‘Studie zu Selbstkontrolle’ (Wagner, 2024a)





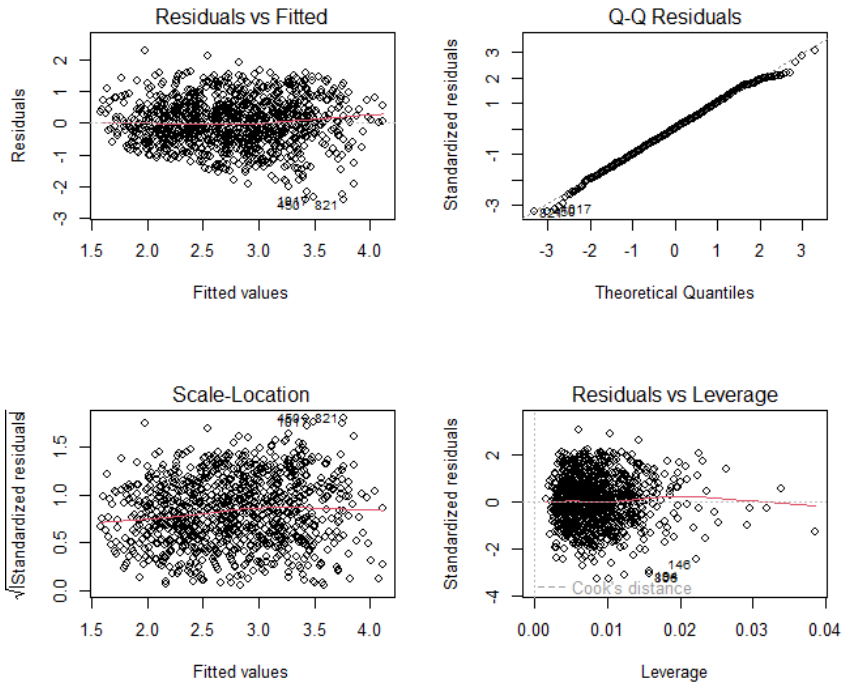
Landing Page and Post of Instagram Account ‘studiezuselbstkontrolle’ (Wagner, 2024b)



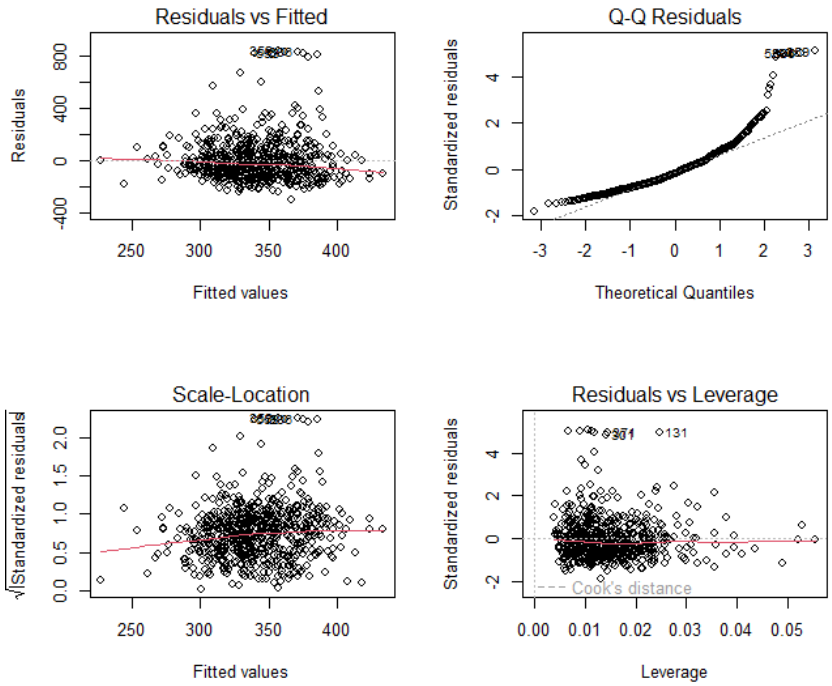
Appendix C

Testing requirements

Requirements for multiple linear regression (H1)



Requirements for mediation – path a (H2)



Requirements for mediation – path b + c (H2)