Registered Report: Self-Control Beyond Inhibition. German Translation and Quality Assessment of the Self-Control Strategy Scale (SCSS).

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The approved STAGE 1 version of the manuscript is available on ~~OSFat~~OSF at this link: https://osf.io/z2xu4. The data is available at this link: https://osf.io/h6p8g/; and materials at this link: https://osf.io/gzyfh/

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Funding acquisition: LHOR, JMJ, OF, ALN, LCS, VW

Investigation: LHOR, JMJ, DM, GC, CM, OF, ALN, LCS, VW

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Abstract

Self-control is crucial for goal attainment and related to several beneficial outcomes, such as health and education. For a long time, it was predominantly understood in terms of inhibition, namely the ability to suppress immediate urges for the sake of long-term goals. Still, research on other self-control strategies has a longstanding tradition and recent research has moved towards a broader approach, integrating different strategies of self-control (e.g., reappraisal or pre-commitment) to gain a more comprehensive perspective on relevant processes in goal protection. The current study aimed to translate and validate the Self-Control Strategy Scale (SCSS, Katzir et al., 2021) to enable its application in German speaking populations while assuring high measurement quality. Across 5 studies (N = 3,400), we assessed the internal structure, reliability and convergent and discriminant validity. Additionally, the strategies' relationship with several self-control outcomes (e.g., achievement, health behavior, or pro-environmental behavior) were tested. The assumed eight-factor structure was confirmed, internal consistency and retest reliability were sufficient for most subscales and the model was invariant between gender and age groups. Convergent and discriminant validity were overall adequate. Different associations emerged between strategies and outcomes, depending on the outcome domain. Thus,- the SCSS appears to be a valid and reliable measure, which can be used in German. The results provide a good starting point for future research on the utility of self-control strategies in different domains.

Keywords: Registered Report, Self-Control, Self-Control Strategies, Translation, Validation, Reliability

Design Table

Question	Hypothesis	Sampling plan	Analysis plan	Rationale for deciding the sensitivity	Interpretation given different outcomes	Theory that could be shown wrong by the outcomes
Aim 1: Assessing the Internal Structure and Reliability of the German Self-Control Strategy Scale						
Factor structure: Does the factor structure of the German Self-Control Strategy Scale (SCSS) align with the original version?	The proposed **eight-factor** model fits the data well.	We first collect a pilot to test the translation and abbreviated introduction. Following, we collect a first full sample to test if last adjustments are needed. Following, we collect data on the SCSS in **three independent samples.**	**CFA:** Using traditional cut-off values for sufficient model fit (RMSEA/SRMR $\leq$ .08; CFI/TLI $\geq$ .90).	We aim to collect **~1800 valid responses,** which is beyond the most conservative suggestion of 1,000 (Kyriazos, 2018)	If fit is sufficient (RMSEA/SRMR $\leq$ .08; CFI/TLI $\geq$ .90), we see the **eight-factor solution** as an appropriate model to the data; if not, we don't.	The eight-factor solution to the SCSS could be shown as invalid for German speaking samples.
	The proposed eight-factor structure is **superior to alternative models** (one-factor & hierarchical solution).		Comparison by Akaike information criterion **(AIC,** < 2 = substantial similarity, 4 - 7 = considerably different, > 10 = essentially none for alternative**)**		If an alternative model fits the data equally well or better (AIC is smaller or difference is < 2**)**, we will state that the proposed structure is **not the only possible solution.**	The eight-factor solution to the SCSS could be shown as not the only optimal structure for German speaking samples.
	The **item-loadings** are sufficient as in Katzir et al. (2021) (> .40).		All **item loadings** > .40		If some item loadings are below the suggested threshold (.40), we will give respective recommendations for **adaptations to the questionnaire.**	Single item loadings could be suboptimal and hence the measurement quality in question.
Reliability: Is the Self-Control Strategy Scale (SCSS) in German reliable?	The subscales' **internal consistencies** are sufficient (***ω*** > .70).	We collect data on the SCSS in **four independent samples.**	***ω*** > .70	We aim to collect **~1800 valid responses,** which is beyond the most conservative suggestion of 1,000 (Kyriazos, 2018)	If some internal consistencies are below the threshold (.70), we will give respective recommendations for **adaptations to the questionnaire.**	The internal consistencies could be suboptimal and hence the measurement quality in question.
	The model is configural, metric and scalar **invariant** for age and gender.		Including respective **restrictions** on the model and monitor if **model fit** remains sufficient		If the model lacks the respective invariance (i.e., some models do not show appropriate fit	The measurement invariance of the model could be limited and accordingly its usability as well.

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			(RMSEA/SRMR $\leq$ .08; CFI/TLI $\geq$ .90). We will include each **gender**-group with > 300 cases. **Age** will be split in three equally sized groups.		(RMSEA/SRMR $\leq$ .08; CFI/TLI $\geq$ .90), its usability might be limited. If full scalar invariance is found, the scale qualifies for **valid mean comparisons** between age groups and gender groups.	
	The subscales **test-retest** reliabilities are sufficient	We collect data in one sample across three timepoints.	Correlation of subscale scores at t2, t3 and t4 (threshold for sufficient reliability: $\mathbf{ICC_{tt}} > 0.70$)	We aim to collect **~150 valid responses** which is beyond the most conservative estimation of $N = 83$ for attaining ICC = .20 and power = 90% (Bujang & Baharum, 2017)	If some test-retest reliabilities are below the threshold (.70), we will give respective recommendations for **adaptations to the questionnaire.**	The test-retest reliabilities could be suboptimal and hence the measurement quality in question.
Aim 2: Assessing Convergent and Discriminant Validity						
Convergent validity: Does the Self-Control Strategy Scale (SCSS) in German explain a relevant amount of variance in trait self-control?	All subscales combined explain a **large amount of variance** ($\mathbf{R^2} \geq 0.26$[1]) in trait self-control (as measured by the Brief Self-Control Scale (Tangney et al., 2004))	Sample 1 will be collected through **Prolific,** limiting the respondents to German speakers; Sample 2 will be collected in the **laboratory with psychology students** for course credit	**Multiple linear regression** on the effect of all subscales combined on trait self-control (threshold for relevant amount of variance: $\mathbf{R^2} \geq 0.26$[1])	For **online** samples (1, 3 & 4) we aim to collect $\boldsymbol{N}$ **= 600** valid cases per sample, achieving a **power of 99.9** for finding an $R^2 \geq .10$ (computation documented in supplemental material) [https://osf.io/p562r]. For the **laboratory** study, we can realistically collect data of $\boldsymbol{N}$ **= 250** participants, which will result in a **power of 97.8** under the same circumstances.	If both measures are strongly associated ($R^2 \geq 0.26$), we suggest measurement of the same construct. If they are weakly associated ($R^2 < 0.26$), we suggest measurement of different constructs.	Potentially SCSS and BSCS measure different constructs of self-control.
Discriminant validity: Does the Self-Control	**All subscales combined may explain a small to**	Sample 1 will be collected through **Prolific,** limiting the respondents to German speakers;	**Multiple linear regression** on the effect of all subscales		If the SCSS **shares** < 26% of variance with related, but theoretically	The analysis could show that the SCSS in German is not distinguished enough from

Strategy Scale (SCSS) in German show enough difference to related but distinct constructs (e.g., lay beliefs about willpower)?	**medium amount of variance in related, but distinct constructs** (full list in the methods section) such as lay beliefs about willpower, **but not a large amount which would indicate that they measure the same construct (R^2 < 0.26[1]).**	Sample 2 will be collected in the **laboratory with psychology students** for course credit, Sample 4 will be collected through **social media** advertisement with the chance to win a voucher.	combined on respective measures (threshold for not too much explained variance: **R^2** < 0.26[1])		distinct constructs, this supports the assumption that it measures a distinct concept. If it does share > 26% of variance, this would indicate considerable overlap.	other constructs.
Aim 3: Assessing the Relationship With Self-Control Outcomes						
Relationship to outcomes: Are the Subscales of the Self-Control Strategy Scale (SCSS) in German related to self-control related outcomes?	**At least one strategy will be significantly related to all outcome measures,** while controlling for all other strategies (and for baseline measurement of outcome in case of longitudinal measurement)[2]	Sample 1 will be collected through **Prolific,** limiting the respondents to German speakers; Sample 2 will be collected in the **laboratory with psychology students** for course credit, Sample 3 and Sample 4 will be collected through **social media** advertisement with the chance to win a voucher.	**Multiple linear regression** on the effect of all subscales combined on each self-control related measures (threshold for coefficient: α < .05).	For **online** samples (1, 3 & 4) we aim to collect ***N* = 600** valid cases per sample, achieving a **power of 99.9** for finding a partial $R^2 \geq .05$ (computation documented in supplemental material) [https://osf.io/p562r]. For the **laboratory** study, we can realistically collect data of ***N* = 250** participants, which will result in a **power of 97.6** under the same circumstances.	If coefficient is significant at **α < .05**, it is significantly related to outcome. If coefficient is not significant at **α > .05** it is not significantly related to outcome.	The analysis could show no evidence that a specific strategy is relevant for a specific outcome.

Note. [1] We interpret R^2 according to Cohen (1988) with $R^2 < .13$ = small, $.13 < R^2 < .26$ = medium and $R^2 > .26$ = large. [2] We have no specific hypotheses on the prediction pattern of the strategies by outcome, thus we will test the hypothesis that each strategy is related to each outcome.

Introduction

Self-control is commonly known to have beneficial effects for individuals. Different meta-analyses have pointed out that higher levels of self-control are associated with a broad array of desirable outcomes in areas such as health, academic achievement or addictive behavior (e.g., de Ridder et al., 2012). Self-control can be defined as the process of adhering to a long-term goal in the face of a conflicting short-term goal (Fujita, 2011). This approach to self-control is highly relatable to personal experiences and can be applied to many real life scenarios. For example, an individual might want to increase their fitness to improve their health by starting to visit the gym regularly. However, when they come back from a tiring day of work they might feel a strong desire to relax on the couch instead. In this situation, they need to find a way to override the immediate desire to hang out on the couch in favor of successfully pursuing their longer-term goal to exercise more.

Historically, research has focused on a person's ability to exert willpower as means to resolve conflicting desires (de Ridder et al., 2012; Fujita, 2011). However, this narrow view of self-control has recently been questioned (e.g., Fujita, 2011; Inzlicht & Friese, 2021; Werner, Inzlicht, et al., 2022) and researchers have extended their focus to a range of strategies people can use to achieve their long-term goals. Prior research shows that people use different strategies (e.g., distracting oneself from the temptation, removing oneself from the situation or reminding oneself of one’s goal) to protect their long-term goals from immediate desires (Milyavskaya et al., 2021). Such strategies are often successful in promoting the long-term goal. Past studies showed that strategies such as distraction from or cognitive change of an immediate reward can help children to wait longer for a later, larger reward (Mischel et al., 1972; Mischel & Baker, 1975). Similarly, modifying situations to remove temptations helped students to meet their academic goals (Duckworth, Gendler, et al., 2016). To allow for the assessment of the broad spectrum of self-control strategies, Katzir et

al. (2021) developed a novel scale - the *Self-Control Strategy Scale* - that assesses some of the main strategies used in desire regulation across different domains.

The present project aims to translate the Self-Control Strategy Scale to German to make it available for application in German-speaking populations while ensuring good measurement qualities. Additionally, we assess the relationship of the individual strategies to a range of self-control related outcomes that have not been investigated previously.

The Self-Control Strategy Scale

The Self-Control Strategy Scale (SCSS) was developed based on past research that identified different strategies to regulate temptations. It was refined and validated across six samples (N = 1946) leading to a final scale including eight strategies of self-control (see Table 1).

Table 1

Strategies and example items of the SCSS (38 items)

Strategy	*N* items	Example Item
Situation Selection **(SS)**	6	I seek out situations in my life so that I will not face temptations.
Punishment **(PU)**	4	I penalize myself for breaking my own "personal contracts".
Reward **(RE)**	4	I reward myself for the achievement of a long-term goal.
Pre-Commitment **(PC)**	4	I tell people about my long-term goals so that they can hold me accountable.
Distraction **(DI)**	5	When I face a temptation, I shift my attention away from it.
Cognitive Change **(CC)**	5	When I encounter a temptation I think about it in a different light.
Acceptance **(AC)**	4	When I face a temptation I accept the craving for it.
Behavioral Inhibition **(BI)**	6	I find it easy to keep myself from acting on unwanted desires.

Eight Strategies of Self-Control

The eight self-control strategies covered in the SCSS can be grouped into three categories theoretically: I) anticipatory control, II) down-regulation of temptation and III) behavioral inhibition. Each of these categories targets specific phases of the process model of self-control (Duckworth, Gendler, et al., 2016). The model posits that self-control failures develop across four phases: (1) encountering a situation that entails a temptation, (2) paying attention to the temptation, (3) appraising the temptation and (4) enacting a response. In any of these phases, people can use certain strategies to decrease the temptation.

Anticipatory control refers to strategies that target the first phase (the situation). These strategies aim to select or create situations where temptations either do not arise as much or are less tempting because of certain imposed contingencies. Examples are avoiding certain situations or changing environments to be less tempting (situation selection), setting up rewards or punishments for certain behaviors or pre-committing to a certain behavior. Note that the term situation selection hence refers to choosing situations (selecting) and adapting situations (modifying), based on factor modeling in Katzir et al. (2021).

Down-regulation of temptation refers to phases 2 (attention) and 3 (appraisal). These strategies aim to divert attention away from the temptation or change the appraisal of the temptation. Examples are distracting oneself from the temptation, thinking about it in a different manner, e.g., more abstractly or rather in terms of its downsides (cognitive change), and approaching it with an accepting mindset.

Finally, behavioral inhibition refers to the last phase (the behavioral response). This category only consists of one strategy - namely effortfully inhibiting the unwanted behavioral response triggered by the temptation.

It is worth noting that these three categories (anticipatory control, down-regulation of temptations, and behavioral inhibition) merely group the strategies concerning the phase of the self-control failure they target. However, people that use one strategy of a certain category

(e.g., situation selection as anticipatory control) do not necessarily also use another one of the same category (e.g., rewards). Thus, this categorization is rather theoretical than representing the empirical factor structure of the measure. In fact, Katzir et al. (2021) found evidence for an eight-factor structure (which was superior to a one-factor model) indicating that the strategies are independent. Still, most strategies correlated positively with one another. The exception was 'acceptance' which showed mostly negative correlations with the other strategies.

In the present project, we aim to investigate the factor structure of the German translation of the SCSS as well as the reliability and measurement invariance of the scale leading to the following hypotheses:

Hypothesis 1: The proposed eight-factor model from Katzir et al. (2021) fits the data of the German SCSS well.

Hypothesis 2: The proposed eight-factor structure is superior to alternative models (a one-factor model and a hierarchical solution where the individual strategies load on a common higher-order factor).

Hypothesis 3: All items load on their respective factors.

Hypothesis 4 & 5: The subscales' internal consistencies and test-retest reliabilities are sufficient.

Hypothesis 6: The model is configural, metric and scalar invariant for age and gender.

Construct Validity of the SCSS

Katzir et al. (2021) assessed convergent validity by investigating the relationship between the subscales of the SCSS and the Brief Self-Control Scale (BSCS, Tangney et al., 2004) which is the most commonly used measure of trait self-control (de Ridder et al., 2012). The BSCS focuses on self-control in terms of effortful inhibition (e.g. I am good at resisting temptation) and self-control success (e.g. People would say that I have iron self-discipline). The individual strategies of the SCSS had varying relationships with the BSCS. For example,

behavioral inhibition was related quite strongly. This is to be expected as inhibition is an explicit part of the BSCS. Other strategies (e.g. pre-commitment) also showed positive associations. This might be because these strategies relate to self-control success which is captured by the BSCS. Still, there were some strategies (e.g., rewards) that were not related to the BSCS at all. However, all strategies combined did predict a considerable amount of variance (66 %) in trait self-control largely due to the strong effect of the behavioral inhibition scale. We aim to replicate this result leading to the following hypothesis.

Hypothesis 7: All subscales combined explain a relevant amount of variance ($R^2 \geq 0.26$) in trait self-control (as measured by the BSCS, Tangney et al., 2004).

We aim to extend the findings on the validity of the SCSS by considering its discriminant validity as well. Past research has investigated a range of different measures related to self-control, such as metacognition about self-control or lay beliefs about willpower. Metacognition about self-control refers to (1) a person's knowledge about their own self-control (e.g., their strengths and weaknesses, their strategy usage) and (2) a person's regulation of self-control conflicts (e.g., planning or monitoring the resolution of a conflict). People higher in metacognition about self-control (especially metacognitive knowledge) use a larger repertoire of self-control strategies to deal with self-control conflicts (Bürgler et al., 2022). Possibly, knowledge about one's weaknesses regarding self-control motivates the usage of a broader range of strategies (e.g., proactive ones) and better regulation enhances the implementation of these strategies.

Lay beliefs about willpower refer to people's beliefs about the nature of willpower (i.e., effortful inhibition) (Job et al., 2010). Some people believe that willpower is a limited resource that depletes upon usage. Others do not see willpower as a limited resource and rather believe that it can be exerted over longer periods of time. Fujita (2011) suggested that people who believe that willpower is limited might be more motivated to search for and adopt other self-control strategies besides effortful inhibition.

Thus, both metacognition about self-control and lay beliefs about willpower may be related to the different strategies of the SCSS. However, they should still represent distinct constructs and thus only share a limited amount of variance as stated in the following hypothesis.

Hypothesis 8: All subscales combined may explain some variance in related, but distinct constructs (i.e., metacognition of self-control and lay beliefs about willpower), but not enough to indicate that they measure the same construct ($R^2 < .26$).

The SCSS and Relevant Self-Control Outcomes

Dispositional self-control has been shown to be related to a number of positive real-world behaviors and outcomes. Domains that have been repeatedly shown to profit from self-control include health behavior (Hofmann et al., 2014; Moffitt et al., 2011), school (de Ridder et al., 2012; Duckworth et al., 2019) and work achievement (Allemand et al., 2019), life satisfaction and interpersonal functioning (de Ridder et al., 2012). Besides, new domains emerge that might as well profit from self-control such as pro-environmental behavior (Nielsen, 2017). For each domain, it is plausible that effortful inhibition is not the only strategy that is effective.

Katzir et al. (2021) evaluated the relationship between the strategies of the SCSS and behavioral domains such as exercise, weight loss and financial saving. They found that the SCSS added to the explained variance beyond the BSCS which mainly assesses effortful inhibition. Consistent with this, previous research showed that different strategies support self-control behavior in other domains with diverging patterns. For example, situation selection and pre-commitment have been shown to increase academic success (Ariely & Wertenbroch, 2002; Duckworth, White, et al., 2016). The latter was also significantly related to physical activity and saving behavior (Katzir et. al., 2021). To reduce social media consumption, Brevers and Turel (2019) reported situation modification behavior to be commonly used (e.g., moving the phone to a different room). In the vein of pro-environmental

behavior, strategies like situation selection (e.g., getting rid of one`s dryer) or cognitive change (e.g., thinking of steak as environmentally harmful instead of tasty) have been suggested (Nielsen, 2017). Similar assumptions can be made for other outcomes as well, such as reframing relationship conflicts as opportunity for growth (cognitive change) or turning off the wifi automatically to go to bed earlier (situation selection).

Overall, these results show the need to study the impact of self-control strategies in different domains because results from one domain might not generalize to another. We will offer new insights in this regard by investigating the SCSS in domains that have not been covered by Katzir et al. (2021), but do rely on self-control (e.g., a broader range of health behaviors, school and work achievement, life satisfaction and interpersonal functioning, and pro-environmental behavior).

Hypothesis 9: At least one strategy is significantly related to health behavior, school and work achievement, life satisfaction and interpersonal functioning, and pro-environmental behavior (while controlling for all other strategies)[1].

Current Study

After delivering first evidence on the model fit, reliability and correlation with other measures, the SCSS needs further validation to unfold its potential. In the current study, we aim for three goals. I) The translation of the SCSS to German and the test of the construct's statistical appropriateness including model fit (against concurrent models), factor loadings and measurement invariance for gender and age, and reliability of the subscales, II) the test of the convergent and discriminant validity of the SCSS, and III) the assessment of its relationship to self-control outcomes expanding to new areas that were not previously considered by Katzir et al. (2021), such as school and work performance, life satisfaction, interpersonal functioning and pro-environmental behavior.

[1] We have no specific hypotheses on the prediction pattern of the strategies by outcome, thus we will test the hypothesis that each strategy is related to each outcome.

Method

Open Practices Statement

The project followed complete open science practices, including open raw data, pre-processing code, prepared data, analysis code, and open access of the manuscript. A plan for pre-registered collaborative secondary data analysis to develop a language invariant short-scale can be found here: https://osf.io/pfdt2.

Translation process

The scale was translated and back translated with a British native speaker. The results were in parallel translated using DeepL. Deviations were discussed and adapted to common language usage. The item which had to be changed the most was *I tell people about my long-term goals so that they can hold me accountable*, where it was decided not to use the direct translation (*hold accountable = zur Verantwortung ziehen*) which would be unconventionally harsh, but to go with *making visible that I stick to my plans*.

Data Quality

To avoid careless or automated responses, we included attention checks throughout the study. The SCSS itself includes three attention checks already. For every 20 additional items, we included one attention check item. Failing to correctly respond to one led to exclusion. To ensure that participants did not contribute to more than one sample, we a) asked them if they had completed the German SCSS before, b) checked the emails in the social media data for duplicates, and c) compared IP addresses. If the IP addresses matched (apart from the laboratory data), we compared the given demographic information. If this information matched as well, only the earliest data remained in the sample. To ensure that participants speak German sufficiently, they reported their German language level at the beginning of each study. Participants who did not indicate that they speak German fluently (or better) were not able to participate. For online data, participants who finished the questionnaire >3SD faster were excluded. There was no exclusion for slow participation. All incomplete datasets

were excluded. The number of exclusions by reason and sample were documented in the supplemental material [https://osf.io/aup93/]. Note that the majority of exclusions was based on incomplete participation, as documented in the supplemental material as well. This exclusion criterion accounted for 86% percent of all exclusions. Demographics descriptions of the sample are in Table 2 and 3.

Table 2

Summary of demographic details of cross-sectional studies 1 and 3-5

	Pilot	**Study 2**	**Study 3**	**Study4**
Sample type	Convenience	Prolific	Social media	Social media
$N_{started}$	45	902	2,746	2,636
$N_{completed}$	45	873	1,335	1,404
$N_{effective}$	41	787	1,165	1,243
Age	34.32 (14.94)	32.13 (10.15)	35.23 (13.12)	35.55 (12.98)
Gender (f/m/o)	61% / 34% / 5%	47% / 52% / 1%	67% / 31% / 1%	71% / 27% / 2%
German language (native / fluent)	98% / 2%	83% / 17%	94% / 6%	94% / 6%

Note. Descriptive data refers to effective *N* (after exclusion), $N_{started}$ = total of participants who started study, $N_{completed}$ = participants who completed study, before exclusion criteria.

Table 3

Summary of demographic details of longitudinal study 1 by measurement time point

	T1	**T2**	**T3**	**T4**
$N_{started}$	172	165	151	153
$N_{completed}$	166	165	151	153
$N_{effective}$ (retention)	159	164	148 (90 %)	148 (90 %)
Age	21.7 (4.27)	21.8 (4.21)	21.7 (4.37)	21.8 (4.30)
Gender (f/m/o)	79% / 19% / 2%	75% / 23% / 2%	76% / 22% / 2%	75% / 23% / 2%
German language (native / fluent)	96% / 4%	95% / 5%	95% / 5%	95% / 5%

Note. The sample was collected from the university participant pool. Descriptive data refers to effective *N* (after exclusion). The sample from T2 is only partially a subset of T1 as

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additional participants were recruited for T2. T3 and T4 are each subsets of T2. Participants that were excluded in T2 (due to exclusion criteria) were also excluded from T3 and T4. Dropout refers to dropout compared to T2 (as this was the main time point of Study 1).

Studies and Procedure

In all samples, individuals first learned about the procedure of the study and that they can stop participating at any given point. Afterwards, they consented to the study and indicated that they were at least 18 years old. Then, the SCSS was presented. As in Katzir et al. (2021), the attention checks were presented at fixed points, and the remaining items were presented in random order. Afterwards, the remaining measures were presented. Last, participants were asked for their demographic details and thanked for their participation. The study ID, population, sample size, time, goals of the specific sampling and used measures are summarized in Table ~~2. The Study~~4. This research consists of ~~four~~three cross-sectional and one longitudinal study. ~~Study 1 served as~~Prior, we conducted a pilot, where participants gave feedback on the translated scale and indicated whether specific aspects remained unclear. Also, this served to test an abbreviated introduction to the scale which focuses less on resisting temptations exclusively, but also includes initiating and persisting in aversive activities. Study ~~2~~1 consisted of students at the University of Vienna, which participated in a longitudinal assessment for course credit. T1 of the assessment was used to test the factor structure and item properties, in case adjustments need to be done. T2 to T4 aimed to test the test-retest reliability of the SCSS (after any adjustments suggested by the results from T1 have been made) and the causal predictions of the SCSS on selected outcomes at a later time point. Further, the moderating influence of goal importance on the causal effect was tested. Studies ~~3~~2 to ~~5 collect~~4 collected cross-sectional data, including the final German version of the SCSS and different self-control related outcomes. Studies ~~2~~1 to ~~5~~4 were used to assess the scale quality (measurement invariance, concurrent factor models). From Study ~~2~~1, T2 was used.

Prolific participants received 2.55£, students received course credit, and social media participants participated in a lottery for a total of 600 Euro in vouchers.

Table 24

Studies and sample specific information

ID	Description	N_p	N_e	Sampling time	Goals	Additional Measures (N items)	
1Pilot	Pilot	40	41	12/23 - 12/23	• translation	Open response field (1)	
21	Students (T1)	300	159	12/23 - 12/23	• factor structure • reliability		
	Students (T2)	240	164	01/24 - 01/24	• retest reliability • longitudinal prediction	University entrance exam rank (1) School performance (1) Goal importance (studying) (2) Goal importance (healthy diet) (2) Goal importance (physical activity) (2)	ADHD (6) BFI-10 (10) Habit strength (studying) (4) Habit strength (healthy diet) (4) Habit strength (physical activity) (4)
	Students (T3)	192	148	01/24 - 01/24	• retest reliability • longitudinal prediction		Habit strength (studying) (4) Habit strength (healthy diet) (4) Habit strength (physical activity) (4)
	Students (T4)	153	148	01/24 - 02/24	• retest reliability • longitudinal prediction	Grade (1)	Habit strength (studying) (4) Habit strength (healthy diet) (4) Habit strength (physical activity) (4)
32	Prolific	600	787	02/24 - 03/24	• factor structure • measurement invariance • cross-sectional predictions	BSCS (13) Willpower beliefs (12) Income (1)	Occupational efficacy (3) Sleep procrastination (9) Satisfaction with life (5) Depressive symptoms (9)
43	Social media 1	600	1,165	02/24 - 03/24	• factor structure • measurement invariance • cross-sectional predictions	Screen time (1-2) Steps (1-2)	Pro-environmental behavior (50) Goal importance (PEB) (2) Pure procrastination scale (12)

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~~5~~4	Social media 2	600	1,243	02/24 - 03/24	• factor structure • measurement invariance • cross-sectional predictions	Burnout (21) MISCS (12) Healthy diet (3)	Relationship satisfaction (6) Conflict in relationships (3) Physical activity (4)

Note. ~~listed~~Listed measures additional to demographics (3 items) and the SCSS (41 items). N_p = planned sample size, N_e = effective sample size (after exclusions)

Measures

Self-Control Strategy Scale (SCSS). As described above, the SCSS (Katzir et al., 2021) measures the engagement in eight self-control strategies (for an overview see Table 1). It includes 38 items (5 reverse coded) measured on a 5-point scale (1 = not at all, 5 = very much).

Goal Importance. Across the studies, goal importance was assessed regarding four specific goals: studying for an exam, maintaining a healthy diet, being physically active and behaving pro-environmentally. For each goal, two items from Katzir et al. (2021) were adapted to assess how important the specific goal is for participants. They were asked to indicate (1) how important the goal behavior is for them (1 = *not at all important*, 5 = *extremely important*) and (2) to what extent they would like to engage in the goal behavior (1 = *not at all*, 5 = *to a high extent*).

Personality. As an economic and validated short-scale to assess the BIG-5 dimensions, we applied the BFI-10 (Rammstedt et al., 2013; Rammstedt & Danner, 2017). The scale has been shown to adequately capture the dimensions compared to more extensive tools (e.g., "I see myself as someone who is reserved.", 1 = not at all, 5 = very much).

Demographics. All participants were asked for their age (in years), their best identified gender (female, male, other) and German language level (native, fluent, good, not so good).

Measures to Assess Convergent and Discriminant Validity

Brief Trait Self-Control Scale. The likely most common measure of self-control is the 13-item BSCS (Tangney et al., 2004). The scale was validated in German (Bertrams & Dickhäuser, 2009) and response options range from 1 = *not at all* to 5 = *very much* (e.g. "I am good at resisting temptation"). It is frequently applied to assess self-control in terms of inhibition.

Lay Beliefs About Willpower. Lay beliefs about willpower were assessed with regard to four self-control domains (strenuous mental activity, resisting temptations, strenuous physical activity and emotion control). The subscales on mental activity, resisting temptations and physical activity were taken from Bernecker and Job (2015) (e.g., "After a strenuous mental activity, my energy is depleted and I need to rest to replenish it."). To cover the emotion control domain, four additional items were adapted from the 6-items scale by Bernecker and Job (2017) (e.g., "Even if I had to keep calm and control my emotions frequently on a given day, it doesn't affect my ability to continue to control my emotions"). All items were answered on a 6-point scale (1 = *strongly agree*, 6 = *strongly disagree*).

Meta-Cognition of Self-Control Scale (MISCS). The scale measures metacognitive knowledge and regulation (Bürgler et al., 2022) using 12 items (e.g., "I understand my strengths and weaknesses when dealing with self-control conflicts.", 1 = *disagree strongly*, 5 = *agree strongly*).

Self-Control Outcomes

Physical Activity. Participants reported the number of minutes they spent on physical activity during the last 7 days with regard to (1) moderate- and (2) vigorous-intensity aerobic physical activity, (3) moderate (or greater) muscle-strengthening activities, and (4) other physical activity. This is based on the WHO (2020) guidelines for physical activity which recommend certain amounts of aerobic and muscle-strengthening activities. A combined score will be created by summing the time spent on each type of physical activity.

Steps. We asked participants to access their step counter on their phone and indicate the average number of steps per day over the last month (if they only had access to data from a shorter time period, e.g., a week, they were asked to indicate that instead). Additionally, they were asked to provide a screenshot of their step counter. Participants had the option to indicate that they cannot or do not want to answer the items. To avoid faulty data, values above 35,000 steps per day were excluded. This cut-off is more than 3 SD above the highest

average daily steps, reported in a meta-analysis on step number and mortality (Paluch et al., 2022).

Healthy Diet. Health and unhealthy food intake was measured via three items adapted from Werner et al. (2022). Participants reported the number of total servings of (1) vegetables, (2) fruits, and (3) high-fat/high-sugar snacks they had consumed during the past 7 days.

Screen Time. We asked participants to access their average screen time on their phone and report the daily average screen time over the last month (if they only had access to data from a shorter time period, e.g., a week, they were asked to indicate that instead). Additionally, they were asked to provide a screenshot of their screen time record. Participants had the option to indicate that they cannot or do not want to answer the items. To avoid faulty data, values above 18 hours per day were excluded.

Sleep Procrastination. To measure the tendency of delaying one's own bedtime, we applied the bedtime procrastination scale (Bernecker & Job, 2020; Kroese et al., 2014) (e.g., "I go to bed later than I had intended", 1 = *(almost) never*, 5 = *(almost) always*). Item 6 ("I do not go to bed on time") was rephrased to "I do go to bed on time" and accordingly recoded in order to ease responding for participants (by avoiding a double negative).

Income. Participants were asked to indicate their pre-tax income from work activities over the last 12 months. They entered the exact amount of income either as a total or as a monthly salary (combined with an indication of the number of monthly salaries they receive in a year).

Procrastination. We used the pure procrastination scale (Steel, 2010) to measure respective tendencies on 12 items (e.g., "I delay making decisions until it's too late", 1 = *strongly disagree*, 7 = *strongly agree*).

Occupational Efficacy. Participant's occupational efficacy was measured by the Short Occupational Self-Efficacy Scale (Rigotti et al., 2008). It consisted of six items (e.g., "I feel

prepared for most of the demands in my job.") assessed on a six-point scale (1 = *not at all true*, 6 = *completely true*).

University Entrance Exam Performance. Students were asked to indicate their rank in the university entrance exam for psychology.

School performance. Students' grades were recorded at the end of the ongoing term through the university administration.

Satisfaction with Life. The five-item Satisfaction with Life Scale (SWLS; Diener et al., 1985) was used in its validated German form (Glaesmer et al., 2011) (e.g., "In most ways my life is close to my ideal", 1 = *strongly disagree*, 7 = *strongly agree*).

Relationship Satisfaction. Relationship satisfaction was measured through the German translation (Hassebrauck, 1991) of the Relationship Assessment Scale (Hendrick, 1988). The scale includes six items (e.g., "How good is your relationship compared to most?") rated on a 5-point scale with varying anchors depending on the item (high values indicate high relationship satisfaction).

Conflict in relationships. Three items from Allemand et al. (2015) were used to assess the occurrence of conflicts in participants' romantic relationships (e.g., "In our marriage/relationship small things end up in big fights"). Participants answered on a 6-point scale (1 = *never* to 6 = *always*).

Pro-Environmental Behavior. The General Ecological Behavior Scale (GEB-50; Kaiser, 2020) is the most widely used measure of general pro-environmental behavior and has the strongest psychometric support (Lange & Dewitte, 2019). It encompasses 50 items from 6 domains of environmental behavior (energy conservation, mobility, waste reduction, consumption, recycling and social commitment). 32 items are assessed on a scale from 1 = *never* to 5 = *very often*. These are later dichotomized to 0 (no pro-environmental behavior) and 1 (pro-environmental behavior). Further 18 items are directly assessed on a binary scale

(1 = *yes*, 0 = *no*). For each item, participants can indicate that the item is not applicable to them. Participants' overall scores are created using the Rasch model.

Habit Strength. We measured habit strength for three specific behaviors: studying for an exam, maintaining a healthy diet, and being physically active. Using the 4-item SRBAI (Gardner et al., 2012), habit strength was assessed for each behavior (e.g., "Maintaining a healthy diet is something… I do automatically", 1 = strongly disagree, 7 = strongly agree)

Exploratory Measures

Burnout. We applied the German version of the 22-item Maslach Burnout Inventory (Büssing & Perrar, 1992; Maslach et al., 1997) (e.g., "I feel emotionally drained by my work", 0 = *never*, 6 = *everyday*).

ADHD. We used the 6-item self-report ADHD screening scale for adults Part A (ASRS-V1.1; Kessler et al., 2005) (e.g., "How often do you have trouble wrapping up the final details of a project, once the challenging parts have been done?", 1 = *never*, 5 = *very often*).

Depressive Symptoms. To assess depressive symptoms, we used the PHQ-9 (Löwe et al., 2002), which was previously validated in the German general population (Martin et al., 2006). It assesses the extent to which a series of symptoms occurred in the past two weeks (e.g., "Little interest or pleasure in doing things", 0 = *not at all*, 3 = *nearly every day*). We only assessed eight of the items, not including the measure for suicidal thoughts and tendencies[2].

~~**Table 3**~~

~~*Summary of demographic details of cross-sectional studies 1 and 3–5*~~

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[2] This was done, due to the online environment of data acquisition, in which our ability to adequately respond to potentially critical circumstances of participants was limited.

	Study 1	Study 3	Study 4	Study 5
$Age_{effective}$	41.32 (14.94)	37.13 (10.15)	35.03 (13.12)	32.57 (12.98)
gender (f/m/o)	75/14/2	368/410/9	286/365/14	886/333/23
$N_{collected}$	45	902	2,746	2,366
German language (native / fluent)	40/1	655/132	1098/67	1165/78

Note. Descriptive data refers to effective *N* (after exclusion).

Table 4

Summary of demographic details of longitudinal study 2 by measurement time point

	T1	T2	T3	T4
Age	21.7 (4.27)	21.8 (4.21)	21.7 (4.37)	21.8 (4.30)
Gender (f/m/o)	125/31/3	123/38/3	113/32/3	111/34/3
German language (native / fluent)	152/7	156/8	141/7	141/7
N (dropout)	159	164	148 (10 %)	148 (10 %)

Note. Descriptive data refers to effective *N* (after exclusion). The sample from T2 is only partially a subset from T1 as additional participants were recruited for T2. T3 and T4 are each subsets from T2. Participants that were excluded in T2 (due to exclusion criteria) were also excluded from T3 and T4. Dropout refers to dropout compared to T2 (as this was the main time point of Study 2).

Data Analysis

Cleaning

Each sample was cleaned based on previously defined standards (see Data Quality). Following this, non-analytically relevant variables were filtered from the datasets (e.g., attention checks), and negative items were reversed. Mean scores for scales and subscales were computed, and demographic information was analyzed by sample. Subsequently, the SCSS data and information on age and gender were combined.

Factor Model Analysis

A series of tests were conducted to assess the model fit, model superiority, reliability, and measurement invariance of the SCSS (in German). The criteria for these assessments are defined here, and their fulfillment is summarized in Table 68. To assess the reliability of the

SCSS, ω was computed by subscale. The criterion for fulfillment is set at all reliabilities exceeding > .70. We computed retest reliability across three measurements, which was judged as sufficient at > .70. For model fit, a confirmatory factor analysis (CFA) was conducted with eight fixed factors, no cross-loadings, and fixed latent-factor variance (= 1, Katzir et al., 2021). Model fit was seen as sufficient with CFI ≥ .90, TLI ≥ .90, and SRMR ≤ .08 (Byrne, 1994) and RMSEA ≤ .08 (Awang, 2012). Further assessment was made to ensure that all items load with > .40. Subsequently, two alternative models were computed: I) a one-factor model and II) a hierarchical model (comprising the eight subscales and a higher-order general factor all subscales load on). These models were compared using the Akaike information criterion (AIC, Akaike, 1974)[3]. Following the model analysis, the SCSS was tested for measurement invariance by gender and age. Each gender category with at least $n = 300$ cases was used, and the age range was split into three equally sized groups. By adding model restraints, configural, metric, and scalar invariance was tested by comparing model fit. The SCSS is considered fully invariant if the CFI and TLI remain ≥ .90, and RMSEA ≤ .08 and SRMR remain ≤ .08. Finally, correlations between strategies were computed in the last step of the analysis.

Validity

To assess convergent and discriminant validity, we tested the relationship of the subscales of the SCSS with another measure of self-control (i.e., BSCS) and measures related to, but distinct from self-control (e.g., lay beliefs about willpower). We computed multiple regressions to assess the contribution of all strategies to the variance in the respective measures. We defined *adj.* $R^2 \geq .26$[4] (convergent validity) and *adj.* $R^2 < .26$[3] (discriminant

[3] The absolute value is not interpretable, just the difference between AICs of different models. The lowest number indicates the most appropriate model fit between the candidate models. In contrast to the lowest value, the other models are judged according to their difference score: < 2 = substantial evidence for model, 4 - 7 = considerably less, > 10 essentially none.

[4] While we used multiple regression to compute the explained variance, we interpret the results strictly non-causal.

validity) as thresholds indicating validity. (R^2 = .26 as threshold for large effects, based on Cohen (1988, p. 414)). Values within these ranges are highlighted with bold print.

Relationship of Individual Self-Control Strategies With Outcomes

For the cross-sectional outcomes in Studies 2-51-4, we conducted multiple regressions to assess the relationship of each strategy with the respective outcome while controlling for all other strategies. We assume that (almost) every outcome will be significantly related to at least one strategy, as in Katzir et al. (2021).

For the longitudinally measured outcomes in Study 21, we conducted multiple regressions to assess the relationship of each strategy measured at T2 with the respective outcomes at T3 (and T4 respectively) while controlling for all other strategies and the outcome measure at T2.

Results

Study 1 (Pilot)

Study 1 served as aPilot: User Experience and Design Adaptation of Questionnaire

The pilot was used to fine-tune the formulation and presentation of the scale as well asand to test the new introduction of the scale. Itinstruction text. The instruction is now not solely focused on suppressing temptations during goal pursuit but includes initiation and endurance of actions against immediate urges. Further it is structured clearly to ease the reading of the instructions. The pilot (https://osf.io/hw9g7) included a total of six open fields for feedback (one for the instructions and five for the pages with the SCSS items). Note that the items were only randomized within the page to connect comments and items easier (e.g. "did not understand question 2"). We extracted the feedback and coded it for whether a specific change is required (https://osf.io/9853n). Following, the first authors discussed every comment and made specific changes byaccording to a) the comments, b) own choices based on general impressions from the comments, and c) design choices by Katzir et al. (2021)

which were not mentioned in the publication but have been found in the available qualtrics script. The specific changes are documented in the supplemental material.

The ~~Study~~pilot was started by 45 participants. Four ~~have been~~participants were excluded through ~~the~~based on failed attention checks. None ~~have been further~~were excluded by other criteria. ~~Hence, the~~The effective sample size was 41 (age: $M = 34.32$, $SD = 14.94$, *Med.* = 29, *range* = [21; 71]) with ~~60.97% female~~61% of participants identifying ~~participants. Asked~~as female. Participants were asked to quantify how understandable the scale was ~~to participants~~ (1 = very unclear, 7 = very clear), the scale was appropriately rated ($M = 4.88$, $SD = 1.76$, *Med.* = 6, *range* = [1, 7]).

Preliminary Results on Self-Control Strategies

Across Studies 1-4 (for Study 1, T2 was used), most of the subscales showed significant, positive relationships with each other (see Table 5). Only acceptance exhibited significant negative relationships with some of the other subscales (e.g., more acceptance was related to less punishment). Only a few relationships reached $r \geq .30$ ($n = 5$) indicating that the subscales are largely independent. Means of ths subscales ranged from $M = 2.51$ (for punishment) to $M = 3.69$ (for reward) indicating that all strategies were used fairly often.

Table 5

Means, standard deviations, reliabilities, and correlations of the SCSS subscales

Variable	*M*	*SD*	ω	*ICC*	SS	PU	RE	PC	DI	CC	AC
Situation Selection	2.85	0.93	.88	.76							
Punishment	2.51	0.91	.74	.83	.29**						
Reward	3.69	1.14	.93	.84	.09**	.25**					
Precommitment	3.32	0.82	.57	.70	.23**	**.33****	**.30****				
Distraction	3.35	0.83	.85	.54	**.31****	.18**	.22**	.22**			
Cognitive Change	3.16	0.81	.78	.67	.21**	.12**	.19**	.22**	**.39****		
Acceptance	3.57	0.81	.78	.79	-.12**	-.26**	.06**	.02	-.06**	.22**	
Behavioral Inhibition	2.94	0.92	.89	.81	.09**	-.00	.09**	.25**	.22**	**.43****	.19**

Note. N = 3,359. ω is McDonald's omega. *ICC* assesses test-retest reliability of the subscales across three measurement time points (after two and four weeks) in Study 1. $r > .30$ are printed in bold. * $p < .05$, ** $p < .01$.

~~**Measurement Quality Assessment**~~

Aim 1: Internal Structure and Reliability

The assessment of the measurement quality of the German translation of the SCSS was performed on the combined data of four independent studies (N = 3,359), namely T2 of Study ~~2 as well as Studies 3-5. The results are summarized in Table 6, which illustrates that the majority of pre-defined criteria was fulfilled completely.~~ 1 as well as Studies 2-4. ~~Three criteria have not been fulfilled in every case. The results indicate promising quality on the overall model level, by showing adequate model fit for the hypothesized factor structure and superior model fit~~, ~~compared to alternative structures (see Table 4) as well as scalar measurement invariance for age and gender (female/male) (see Table 5).~~

~~**Table 4**~~

Hypotheses 1 - 3: Adequate Factor Structure

Hypothesis 1 (adequate fit of proposed eight-factor model) was accepted as the fit indices reached the pre-registered thresholds (RMSEA/SRMR ≤ .08; CFI/TLI ≥ .90). Hypothesis 2 (superior fit of eight-factor model over alternative hierarchical or one-factors models) was supported by the pre-registered AIC criterion. The difference to both alternative

models was > 10 and hence the candidate model received the best support. Further, both alternatives missed at least one criterion in the cut-offs. The respective results are summarized in Table 6.

Table 6

Results of the comparison of the fit of the 8-factor, 1-factor and hierarchical model of the subscales of the SCSS

Model	*CFI*	*TLI*	*RMSEA*	*SRMR*	*AIC*
8-factor model	.93	.92	.044	.059	347,396
Hierarchical model	.90	.90	.049	.084	348,701
One-factor model	.30	.26	.132	.146	382,387

Note. The 8-factor model includes separate (correlated) factors for each of the subscales. ~~The one-factor model includes a single factor that all items load on.~~ The hierarchical model includes separate factors for each of the subscales which in turn load on a common second-order factor. The one-factor model includes a single factor that all items load on.

~~**Table 5**~~

Hypothesis 3 (factor loadings of > .40 of all items on their respective factor) was supported for most items. One item, from the punishment subscale (SCSS_8_PM), missed this criterion very sharply (.39), the other item, from the precommitment subscale (SCSS_17_PC), showed a rather inadequate factor loading (.25).

Hypothesis 4 and 5: Internal Consistency and Test-Retest Reliability

Hypothesis 4 (adequate internal consistency of ω > .70 in all subscales) was supported for seven of the eight subscales (see Table 5), except pre-commitment (ω = .57), which yet fulfilled the criterion for test-retest reliability of Hypothesis 5 (adequate ICC > .70 across three measures). This was achieved in six subscales with the exceptions being the subscales distraction and cognitive change (see Table 5).

Hypothesis 6: Measurement Invariance By Age and Gender

As displayed in Table 7, Hypothesis 6 (scalar measurement invariance for gender [female/male] and between three equally sized age groups) was fulfilled as the scalar factor models remained above the pre-defined thresholds (RMSEA/SRMR ≤ .08; CFI/TLI ≥ .90).

Table 7

Results of test for measurement invariance by gender and age

Model	***CFI***	***TLI***	***RMSEA***	***SRMR***
Base	.93	.92	.044	.059
Age				
configural	.98	.98	.065	.064
metric	.98	.98	.065	.065
scalar	.98	.98	.062	.065
Gender				
configural	.98	.98	.066	.063
metric	.98	.98	.065	.063
scalar	.98	.98	.064	.063

Note. Base refers to the 8-factors model across all gender and age groups. Standard (non-scaled) fit measures are reported.

Summary of Aim 1

The overall results regarding internal structure and reliability are summarized in Table 8, which illustrates that the majority of pre-defined criteria was fulfilled completely. Three criteria have not been fulfilled in every case. The results indicate promising quality on the overall model level, by showing adequate model fit for the hypothesized factor structure and superior model fit~~The unfulfilled criteria range on the subscale and item level. Two items missed the target of loading >.40 on their factor. One item, from the punishment subscale (SCSS_8_PM), missed this criterion very sharply (.393), the other item, from the precommitment subscale (SCSS_17_PC), showed a rather inadequate factor loading (.246). This is likely related to the violation of ω > .70 for all subscales, as precommitment showed a~~

~~less optimal internal consistency of ω = .57 (see Table 7). Yet, the same subscale fulfilled the criterion for retest reliability of ICC > .70, computed across three measurements, which was violated by distraction and cognitive change.~~

~~**Table 6**~~

compared to alternative structures (see Table 5) as well as scalar measurement invariance for age and gender (female/male) (see Table 7).

Table 8

Checklist on criteria for quality assessment on factor model of SCSS

Criteria	Fulfilled	Not fully fulfilled
Items loadings (8-factor model): > .40 for all items		x (2)[1]
Internal consistency: ω > .70 for all subscales		x (1)[1]
Test-retest reliability: *ICC* > .70 for all subscales		x (2)[1]
8-factor model fits well	x	
8-factor model fits better than one-factor model	x	
8-factor model fits better than hierarchical model	x	
Measurement invariance: gender		
Configural	x	
Metric	x	
Scalar	x	
Measurement invariance: age		
Configural	x	
Metric	x	
Scalar	x	

Note. [1] It is stated in parentheses how many instances (e.g., subscales or items) failed the threshold.

~~Most of the subscales showed significant, positive relationships with each other. Only acceptance exhibited significant negative relationships with other subscales (e.g., more acceptance was related to less punishment and the other way around). The minority of relationships reached to/beyond r > .30 (n = 5) supporting the findings of the confirmatory factor analysis, that the subscales are best modeled as independent factors.~~

~~Table 7~~

~~*Means, standard deviations, reliabilities, and correlations of the SCSS subscales*~~

~~Variable~~	~~*M*~~	~~*SD*~~	~~ω~~	~~*ICC*~~	~~SS~~	~~PU~~	~~RE~~	~~PC~~	~~DI~~	~~CC~~	~~AC~~
~~Punishment~~	~~2.51~~	~~0.91~~	~~.74~~	~~.83~~	~~.29**~~						
~~Reward~~	~~3.69~~	~~1.14~~	~~.93~~	~~.84~~	~~.09**~~	~~.25**~~					
~~Precommitment~~	~~3.32~~	~~0.82~~	~~.57~~	~~.70~~	~~.23**~~	~~**.33****~~	~~**.30****~~				
~~Distraction~~	~~3.35~~	~~0.83~~	~~.85~~	~~.54~~	~~**.31****~~	~~.18**~~	~~.22**~~	~~.22**~~			
~~Cognitive Change~~	~~3.16~~	~~0.81~~	~~.78~~	~~.67~~	~~.21**~~	~~.12**~~	~~.19**~~	~~.22**~~	~~**.39****~~		
~~Acceptance~~	~~3.57~~	~~0.81~~	~~.78~~	~~.79~~	~~-.12**~~	~~-.26**~~	~~.06**~~	~~.02~~	~~-.06**~~	~~.22**~~	

~~***Note.*** ***N* = 3,359. ω is McDonald's omega.** ***ICC*** **assesses test-retest reliability of the subscales across three measurement time points (after two and four weeks) in Study 2~~

~~2~~Aim 2: Convergent and Discriminant Validity

Hypothesis 7: Convergent Validity

Hypothesis 7 (the SCSS subscales combined explain at least 26 % of the variance in the brief self-control scale ($R2 \geq .26$)) was supported as all eight subscales of the SCSS explained 59 % of the variance (see Table 9).

Hypothesis 8: Discriminant Validity

Hypothesis 8 (the SCSS subscales combined explain less than 26 % of the variance in the willpower beliefs and ~~*r* > .30 are printed in bold. * *p* < .05, ** *p* < .01.~~

~~Further, the criteria for convergent and discriminant validity have been mostly fulfilled, except for explained variance of the~~ meta-cognition in self-control ~~scale (MISCS). This scale's variance~~ ($R^2 < .26$) was partially supported. The explained ~~by 30% and hence~~variance in willpower beliefs remained below the given threshold ($R^2 = .19$) but the explained variance in meta-cognition in self-control exceeded ~~the threshold~~ it by 4% ($R^2 = .30$) (see Table ~~8).~~ 9).

To our interpretation, sufficient convergent validity and partial discriminant validity can be assumed, based on the current data.

Table ~~8~~9

Multiple Regressions of SCSS subscales on related measures to assess convergent and discriminant validity.

	n	SS	PU	RE	PC	DI	CC	AC	BI	R^2
Convergent										
Brief self-control scale	787	.07**	.01	-.01	**.15*****	.00	.03	-.03	**.69*****	**.586**
Discriminant										
Meta-cognition in self-control	1243	.08**	.08**	.10***	.13***	.06*	**.27*****	.11***	**.15*****	**.300**
Lay theories of willpower	787	.01	.04	-.10**	.06	-.08*	**.17*****	-.00	**.35*****	**.192**

Note. *$p < .05$, ** $p < .01$, *** $p < .001$; n = sample size of specific test. Standardized regression coefficients. Bold print for significant $\beta \geq .15$ and *adj.* $R^2 \geq .10$. Sorted by explained variance within category.

~~Relationship~~Preliminary Results on Relationships of Self-Control Strategies With ~~Self-Control~~Related Outcomes

A first look at the simple correlations between the eight self-control strategy subscales and the self-control related outcomes (see Table ~~9~~10) shows that the subscales differ in how strongly they are associated with the outcomes. Behavioral inhibition shows the highest number and strength of connections~~ and simultaneously the strongest connections~~. For example, it is positively associated with life satisfaction and negatively associated with procrastination. ~~Following this, pre~~Pre-commitment and cognitive change also ~~exhibit several favorable correlations~~correlate favorably with outcomes (e.g., higher life satisfaction and reduced procrastination). The remaining subscales show less associations, but each shows some beneficial connections to outcomes, e.g., situation selection is related to stronger habit regarding physical activity, punishment is related to better grades, rewards are associated with occupational self-efficacy, distraction relates to lower procrastination and acceptance relates to better habits regarding healthy diet. Importantly, punishment does not only show positive associations, but also has some harmful connections to depressive symptoms and burnout.

Table ~~9~~10

Correlations of SCSS Subscales and ~~Related~~Other Measures

	SS	PU	RE	PC	DI	CC	AC	BI
Satisfaction / interpersonal functioning								
Life satisfaction	.07	-.02	.12***	**.30***	.05	.14***	.10**	.28***
Relationship satisfaction	.09*	-.03	.07	.12***	.11**	.17***	.01	.21***
Relationship conflict	-.11**	.01	-.06	-.11**	-.09*	-.12***	-.03	-.13***
School / work achievement								
Habit strength: studying (t3)	.05	.04	-.08	.12	-.05	.14	.04	.26**
Habit strength: studying (t4)	.05	.02	-.07	.12	-.07	.12	.06	.26**
Procrastination	-.07*	.00	-.10***	-.27***	-.19***	-.29***	-.17***	**-.55***
Occupational self-efficacy	.10*	-.01	.14***	.29***	.12**	.27***	.21***	**.33***
Grades	.03	-.28**	.06	-.13	-.17	.05	.24*	-.06
Income	.02	.01	-.03	.11**	-.04	.03	.09*	.13***
Entrance exam rank	.04	.11	.10	.00	-.13	.06	-.10	-.00
Health behavior								
Habit strength: healthy diet (t3)	.08	-.08	.01	-.04	.09	.17*	.21*	.22**
Habit strength: healthy diet (t4)	.08	.06	-.00	.11	.01	.12	.18*	**.32***
Habit strength: phys. act. (t3)	.19*	.12	.04	.12	.02	.02	.07	.27***
Habit strength: phys. act. (t4)	.17*	.14	.00	.07	-.06	.07	.03	.26**
Bedtime procrastination	-.08*	-.02	-.04	-.18***	-.09*	-.14***	.02	**-.33***
Snacking	-.07*	.06*	-.02	-.03	-.12***	-.18***	-.05	**-.32***
Fruit / vegetable intake	.10***	.00	.03	.10***	.07*	.09**	.04	.13***
Physical activity	-.03	-.05	-.03	-.01	.00	.06*	.07**	.14***
Daily steps (obj.)	.08	.00	-.02	-.02	.04	.10*	-.03	.15***
Daily steps	.10**	.05	.02	-.00	.04	.07*	-.02	.09*
Daily screen time (obj.)	-.03	.07	.01	.01	-.03	-.07	-.06	-.14**
Daily screen time	-.06	.03	.03	-.04	-.07	-.13***	-.06	-.13***
Pro-environmental behavior								
General Ecological Behavior	.07*	-.02	.03	.10***	.07*	.12***	.05	.16***
Exploratory outcomes								
Extraversion	.01	.01	.09	.10	.03	.20**	.11	.21**
Agreeableness	.06	-.03	-.06	.01	.02	-.07	-.02	.18*
Conscientiousness	.20**	.29***	.10	**.39***	.07	.18*	-.05	**.44***
Neuroticism	-.01	.13	-.03	.10	.10	-.13	**-.33***	-.29***
Openness	.00	.07	.07	.14	.02	.02	.16*	.07
Depressive symptoms	-.02	.12**	-.05	-.20***	-.07*	-.11**	-.07	**-.39***
Burnout	.04	.21***	-.09**	-.08**	-.11***	-.20***	-.21***	**-.30***
ADHD	-.07	-.10	.02	-.11	-.07	-.12	-.01	**-.40***
Self-control related constructs								
Brief self-control scale	.21***	.13***	.08*	**.35***	.24***	**.35***	.00	**.74***
Meta-cognition in self-control	.21***	.15***	.24***	**.31***	.27***	**.45***	.19***	**.35***
Lay theories of willpower	.09*	.08*	-.03	.16***	.09**	.28***	.02	**.41***

Note. Correlation coefficients ≧ .30 marked in bold print. *$p < .05$, ** $p < .01$, *** $p < .001$

~~As~~Aim 3: Assessing the ~~main analysis, we assessed the relationships of~~ Relationship With Self-Control Outcomes

Hypothesis 9 (at least one strategy is related to each ~~subscales with the~~outcome in health behavior, school/work achievement, life satisfaction, interpersonal functioning and pro-environmental behavior) was partially supported. The outcomes ~~while~~and regression parameters are summarized in Table 11. At least one strategy significantly related to each of the outcomes apart from grades, daily screen time (assessed through self-report), and habit strength of studying. Quantified, this means that 3 of 23 outcomes were not related to any single self-control strategy when controlling for ~~the~~all other strategies.

Table 11

Multiple Regressions of SCSS Subscales on Related Measures

	n	SS	PU	RE	PC	DI	CC	AC	BI	Hab[c]	R^2
Satisfaction / interpersonal functioning											
Life satisfaction	787	.05	**-.16*****	.07	**.29*****	-.07	.03	.05	**.20*****		**.158**
Relationship satisfaction	783	.06	-.07	.04	.06	.02	.08	-.07	**.16*****		.055
Relationship conflict	783	-.08*	.05	-.03	-.06	-.02	-.05	.02	-.08*		.025
School / work achievement											
Habit strength: studying (t3)	148	-.01	-.05	-.09	-.03	.01	-.05	.01	.08	**.72*****	**.559**
Habit strength: studying (t4)	148	.03	-.04	-.08	-.02	-.02	-.07	.00	.10	**.69*****	**.514**
Procrastination	1165	-.00	.07*	-.00	**-.15*****	-.05	-.02	-.03	**-.49*****		**.327**
Occupational self-efficacy	604	.05	-.13**	.06	**.25*****	-.03	.13**	**.17*****	**.21*****		**.213**
Grades[a]	102	.20	-.22	.11	-.08	-.16	.01	.18	-.02		.086
Income[b]	785	.03	.01	-.07	.11**	-.09*	-.01	.08*	.12**		.033
Entrance exam rank[a]	164	.05	.13	.13	-.08	**-.22****	.15	-.13	-.05		.032
Health behavior											
Habit strength: healthy diet (t3)	148	.06	-.01	-.02	-.07	.03	-.04	.11*	.08	**.74*****	**.664**
Habit strength: healthy diet (t4)	148	.08	.04	-.01	-.03	.02	-.14*	.13*	**.15****	**.78*****	**.664**
Habit strength: phys. act. (t3)	148	.12*	.03	-.01	-.06	.02	-.11*	.12*	.06	**.79*****	**.662**
Habit strength: phys. act. (t4)	148	**.16****	.07	-.02	-.12*	-.09	-.03	.07	.05	**.77*****	**.625**
Bedtime procrastination	787	-.04	.07	-.01	-.12**	.02	-.00	.06	**-.31*****		**.116**
Snacking	1240	-.05	.06	-.00	.06	-.04	-.04	.03	**-.31*****		**.109**
Fruit / vegetable intake	1243	.08*	-.03	-.00	.06	.01	.01	.01	.10**		.024
Daily steps (obj.)	559	.07	-.01	-.02	-.06	-.02	.06	-.07	**.16*****		.023
Physical activity	1243	-.02	-.01	-.03	-.03	-.01	.01	.04	.14***		.019
Daily screen time	676	-.05	.05	.06	-.02	-.02	-.08	-.02	-.07		.018
Daily screen time (obj.)	561	-.04	.07	-.00	.03	-.00	-.01	-.01	-.14**		.012
Daily steps	713	.08*	.03	.01	-.06	-.02	.04	-.04	.09*		.010
Pro-environmental behavior											
General Ecological Behavior	1165	.06	-.08*	-.00	.07*	.00	.06	-.01	.11***		.031

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$; *n* = sample size of specific test. Standardized regression coefficients. Bold print for significant $\beta > .15$ and *adj.* $R^2 > .10$. Sorted by explained variance within category. [a]Low numbers indicate a higher rank / a better grade. [b]One participant was excluded for reporting an annual income > 200 million € and one didn't have a specification of paid months per year. [c]Habit strength of the respective behavior (studying / healthy diet / physical activity) at ~~subscales in multiple linear regressions.~~ T2; used as a control variable for longitudinal data.

Consistent with the results from the simple correlations, there was ~~some~~ heterogeneity in the associations between the strategies and ~~the assessed~~ outcomes. ~~Evident from Table 10, behavioral~~Behavioral inhibition was the central strategy~~,~~ related to outcomes in ~~an adaptive~~a positive way (e.g., higher life satisfaction, less bedtime procrastination, see Table 11). Precommitment and distraction showed ~~adaptive~~favorable relationships, mostly within the field of school and work achievement, while precommitment was also meaningfully related to higher life satisfaction.

Situation selection and acceptance showed a smaller number of positive relationships to the outcomes. Situation selection was related to positive habits regarding physical activity as well as less relationship conflict, more fruit and vegetable intake and more daily steps but the latter ones with a rather small magnitude. Acceptance was related to occupational self-efficacy and health-related habits. Still, these results indicate that both situation selection and acceptance are related to the outcomes beyond the other strategies (e.g., behavioral inhibition).

Other strategies showed almost no relationships to the outcomes once the other strategies were accounted for. Rewards as self-control strategy stood out across studies as being unrelated to almost all outcomes, which is in line with earlier findings (Katzir et al., 2021). Cognitive change was also unrelated to most outcomes. The observed significant relationships were arbitrary, with some positive relationships (e.g., related to more occupational self-efficacy) and some negative relationships (e.g., reduced habit strength in healthy eating and physical activity). This is interesting as cognitive change showed ~~a number of~~several beneficial associations when looking at the simple correlations. It seems that some of the positive associations of cognitive change are dependent on another strategy (possibly behavioral inhibition as the two strategies were considerably correlated) and thus disappear once that strategy is controlled for.

Last, punishment ~~showed to be~~was mostly a ~~maladaptive~~detrimental strategy, being related in unfavorable ways to a range of outcomes (e.g., less life satisfaction, more procrastination, or less occupational self-efficacy). ~~Interestingly~~However, these negative associations did not emerge ~~when looking at~~in the simple correlations. This indicates a concurrent suppressor effect through one or more of the other strategies (possibly precommitment as this is the strongest correlator of punishment). The negative associations of punishment only show once the positive effect of e.g., precommitment is accounted for.

The longitudinal data on habit strength showed the necessity to consider past behavior in the prediction of future behavior, as past habit strength was the dominant predictor of future habit strength beyond almost all self-control strategies, with some added explained variance, especially through behavioral inhibition, acceptance, and situation selection.

~~**Table 10**~~

~~*Multiple Regressions of SCSS Subscales on Related Measures*~~

	#	SS	PU	RE	PC	DI	CC	AC	BI	Hab[a]	R^2
Satisfaction / interpersonal functioning											
Life satisfaction	787	.05	-.16***	.07	.29***	-.07	.03	.05	.20***		.158
Relationship satisfaction	783	.06	-.07	.04	.06	.02	.08	-.07	.16***		.055
Relationship conflict	783	-.08*	.05	-.03	-.06	-.02	-.05	.02	-.08*		.025
School / work achievement											
Habit strength: studying (t3)	148	-.01	-.05	-.09	-.03	.01	-.05	.01	.08	.72***	.559
Habit strength: studying (t4)	148	.03	-.04	-.08	-.02	-.02	-.07	.00	.10	.69***	.514
Procrastination	1165	-.00	.07*	-.00	-.15***	-.05	-.02	-.03	-.49***		.327
Occupational self-efficacy	604	.05	-.13**	.06	.25***	-.03	.13**	.17***	.21***		.213
Grades[a]	102	.20	-.22	.11	-.08	-.16	.01	.18	-.02		.086
Income[b]	785	.03	.01	-.07	.11**	-.09*	-.01	.08*	.12**		.033
Entrance exam rank[a]	164	.05	.13	.13	-.08	-.22**	.15	-.13	-.05		.032
Health behavior											
Habit strength: healthy diet (t3)	148	.06	-.01	-.02	-.07	.03	-.04	.11*	.08	.74***	.664
Habit strength: healthy diet (t4)	148	.08	.04	-.01	-.03	.02	-.14*	.13*	.15**	.78***	.664
Habit strength: phys. act. (t3)	148	.12*	.03	-.01	-.06	.02	-.11*	.12*	.06	.70***	.662
Habit strength: phys. act. (t4)	148	.16**	.07	-.02	-.12*	-.09	-.03	.07	.05	.77***	.625
Bedtime procrastination	787	-.04	.07	-.01	-.12**	.02	-.00	.06	-.31***		.116
Snacking	1240	-.05	.06	-.00	.06	-.04	-.04	.03	-.31***		.109
Fruit / vegetable intake	1243	.08*	-.03	-.00	.06	.01	.01	.01	.10**		.024
Daily steps (obj.)	559	.07	-.01	-.02	-.06	-.02	.06	-.07	.16***		.023
Physical activity	1243	-.02	-.01	-.03	-.03	-.01	.01	.04	.14***		.019
Daily screen time	676	-.05	.05	.06	-.02	-.02	-.08	-.02	-.07		.018
Daily screen time (obj.)	561	-.04	.07	-.00	.03	-.00	-.01	-.01	-.14**		.012
Daily steps	713	.08*	.03	.01	-.06	-.02	.04	-.04	.09*		.010
Pro-environmental behavior											
General Ecological Behavior	1165	.06	-.08*	-.00	.07*	.00	.06	-.01	.11***		.031
Exploratory outcomes											
Conscientiousness	164	.06	.08	.03	.28***	-.00	.07	-.08	.38***		.295
Depressive symptoms	787	-.01	-.21***	-.04	-.18***	.01	.04	-.00	-.36***		.188
Burnout	1145	.05	-.21***	-.09**	-.05	-.05	-.06	-.09**	-.22***		.153
Neuroticism	164	-.11	.10	-.04	.10	.08	.04	-.25**	-.28***		.153

ADHD	164	-.01	.04	.06	-.06	-.06	.01	.07	-.42***	.137
Extraversion	164	-.02	-.03	.05	.10	-.01	.13	.04	.15	.030
Agreeableness	164	.07	-.12	-.07	-.00	.05	-.15	-.04	.26**	.022
Openness	164	-.03	.08	.05	.15	.04	-.06	.22*	.01	.017

Note. *$p < .05$, ** $p < .01$, *** $p < .001$; n = sample size of specific test. Standardized regression coefficients. Bold print for significant $\beta \geq .15$ and *adj.* $R^2 \geq .10$. Sorted by explained variance within category. [a]Low numbers indicate a higher rank / a better grade. [b]One participant was excluded for reporting an annual income > 200 million € and one didn't have a specification of paid months per year. [c]Habit strength of the respective behavior (studying / healthy diet / physical activity) at t2; used as a control variable for longitudinal data.

Exploratory Analyses

In additional analyses, we recomputed all multiple regression models described in the previous section without behavioral inhibition as a predictor. These are documented in the supplemental material. Besides, we ran similar regression models assessing the relationships of the self-control strategies with exploratory variables concerning mental health and personality.

Mental Health and Personality

The exploratory results offer informative insights into the relationship of mental health symptomatology and self-control strategies. While behavioral inhibition appears to be related to less symptomatology explained between 13 % and 19 % of the variance in burnout, the assessed mental health variables–depressive symptoms, burnout, and ADHD, punishment seems to be maladaptive. In burnout as well as depressive symptoms, punishment. Behavioral inhibition was the strongest predictor of all three of them. It is related to higher symptom scores. fewer symptoms of burnout, depression, and ADHD symptomatology was intuitively related. The relationship to ADHD is intuitive because difficulties with less behavioral inhibition. Interestingly, the current study are a core symptom of ADHD. It is, however,

interesting that we did not observe the compensatory use of other self-control strategies. Besides, pre-commitment is also related to fewer depressive symptoms. Punishment, in contrast, seemed to be maladaptive. It was associated with higher symptom scores of burnout and depression. Future advances in clinical samples can potentially deliver more specific insights.

Of the personality variables, conscientiousness and neuroticism shared the largest amount of variance with the self-control strategies subscales. Conscientiousness was ~~strongly~~strongest related to the self-control strategies, mainly through positive associations with precommitment and behavioral inhibition, which appeared intuitive. Neuroticism was negatively related to acceptance and behavioral inhibition.

Table 12

Exploratory Multiple Regressions of SCSS Subscales on Related Measures

	n	**SS**	**PU**	**RE**	**PC**	**DI**	**CC**	**AC**	**BI**	**R^2**
Mental Health										
Depressive symptoms	787	-.01	**.21*****	-.04	**-.18*****	.01	.04	-.00	**-.36*****	**.188**
Burnout	1145	.05	**.21*****	-.09**	-.05	-.05	-.06	-.09**	**-.22*****	**.153**
ADHD	164	-.01	.04	.06	-.06	-.06	.01	.07	**-.42*****	**.137**
Personality										
Conscientiousness	164	.06	.08	.03	**.28*****	-.00	.07	-.08	**.38*****	**.295**
Neuroticism	164	-.11	.10	-.04	.10	.08	.04	**-.25****	**-.28*****	**.153**
Extraversion	164	-.02	-.03	.05	.10	-.01	.13	.04	.15	.030
Agreeableness	164	.07	-.12	-.07	-.00	.05	-.15	-.04	**.26****	.022
Openness	164	-.03	.08	.05	.15	.04	-.06	**.22***	.01	.017

Multilevel Model on Habit Strength

Using a mixed-effects multilevel model under the control of time-lagged auto-correlation of habit strength (lag-1) across three measurements indicated a positive effect of behavioral inhibition on future habit strength (see Table ~~11~~13). The small negative time-

lagged effect of auto-correlation indicated that habit strength is not monotonous rising across time, but that higher habit strength predicts a decrease across time. This is, however, likely an artifact of centering time-lagged habit strength within participants.

Table ~~11~~13

Results of exploratory multilevel models on the effect of SCSS subscales on habits strength of three behaviors while controlling for previous habit strength

	Habit strength: studying			Habit strength: healthy diet			Habit strength: physical activity		
Predictors	β	CI	p	β	CI	p	β	CI	p
Intercept	0.00	[-0.15, 0.15]	.104	-0.01	[-0.16, 0.14]	.134	0.00	[-0.15, 0.16]	.650
SS (t2)	0.03	[-0.13, 0.20]	.701	0.10	[-0.06, 0.27]	.222	0.16	[-0.00, 0.33]	.052
PU (t2)	-0.05	[-0.22, 0.12]	.551	-0.06	[-0.24, 0.11]	.474	0.06	[-0.11, 0.24]	.459
RE (t2)	-0.10	[-0.26, 0.06]	.214	-0.02	[-0.18, 0.14]	.793	0.01	[-0.15, 0.17]	.931
PC (t2)	0.11	[-0.05, 0.28]	.186	-0.03	[-0.19, 0.14]	.758	0.04	[-0.13, 0.21]	.665
DI (t2)	-0.08	[-0.25, 0.08]	.312	0.07	[-0.09, 0.24]	.383	-0.04	[-0.20, 0.13]	.652
CC (t2)	0.09	[-0.09, 0.26]	.336	-0.01	[-0.19, 0.17]	.906	-0.07	[-0.24, 0.11]	.472
AC (t2)	-0.04	[-0.21, 0.14]	.668	0.17	[-0.00, 0.35]	.052	0.09	[-0.09, 0.26]	.336
BI (t2)	**0.24**	[0.07, 0.41]	.006	**0.22**	[0.05, 0.39]	.012	**0.25**	[0.07, 0.42]	.005
Previous habit (lagged)	**-0.08**	[-0.13, -0.04]	<.001	**-0.06**	[-0.10, -0.02]	.005	**-0.06**	[-0.10, -0.02]	.002

Note. Standardized betas are reported. Previous habit strength (lagged) was centered within clusters. Coefficients significant at $p < .05$ are printed in bold.

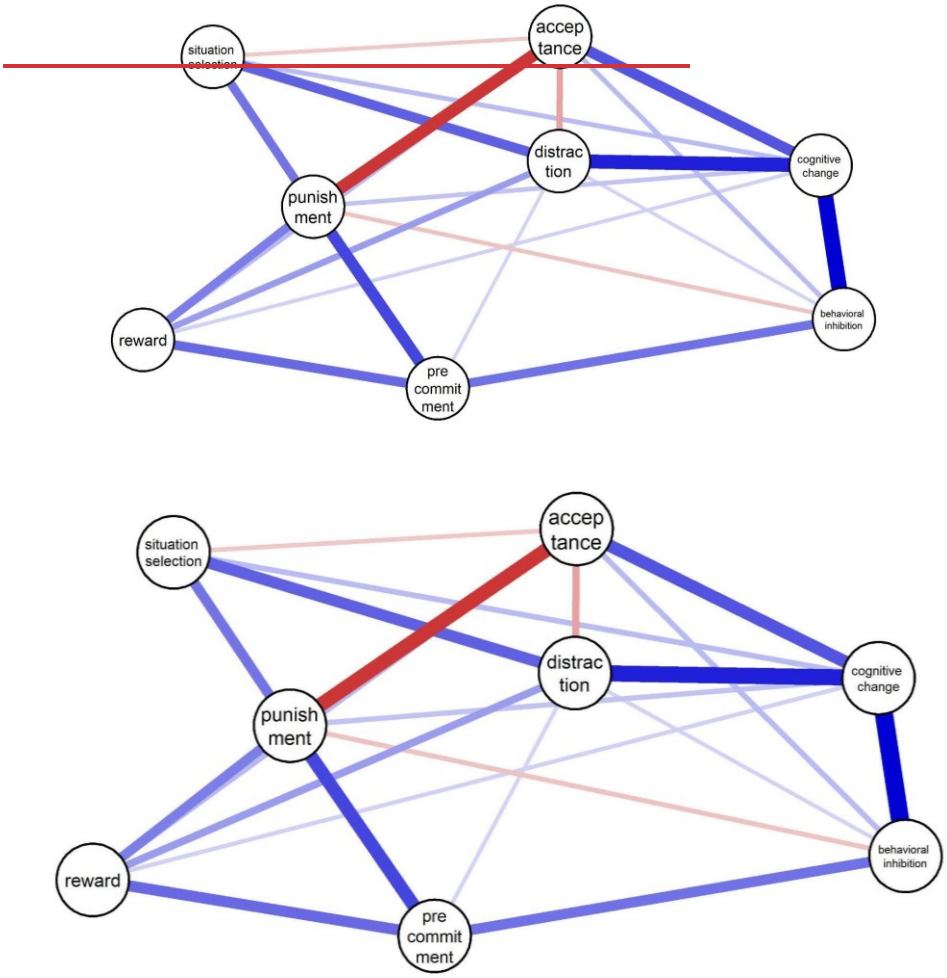
Network Model of Self-Control Strategies

Using a lasso-regularized network model, we computed the relationships between all strategies while controlling for the influence of all other strategies in the model. ~~The thresholded model is plotted in Figure 1.~~Lasso-regularization is used to reduce model complexity by setting spurious edges (connections between variables) to zero (e.g. see absent path between situation selection and reward, even though the small correlation was significant, see Table 8). Given that with large enough samples, even weak relationships can reach significance, this is crucial to highlight the most important relationships within the

network. For further details on this method, we refer to the respective tutorial by Epskamp and Fried (2017). The thresholded model is plotted in Figure 1.

Figure 1

Exploratory regularized network model of self-control strategies



Note. The edges (connections between variables) can be read as partial correlations. Red indicates negative relationships and thickness indicates the strength of the relationship.

The standardized centrality plot can be found in the supplemental material. It indicates that cognitive change is the most central strategy of the network in terms of strength, betweenness, and closeness. ~~As shown in Figure 1, acceptance~~Acceptance has the most negative edges with other strategies, potentially indicating that the acceptance of a self-control conflict is related to less strategy usage. Otherwise, the strategies are mostly positively related. ~~This indicates that using~~Using one strategy, thus, rather relates to using another one as well instead of using the strategies compensatorily.

Discussion

We tested the quality of the SCSS from different angles to assess its usability in the field of self-control research and to facilitate its application with German-speaking participants. To do so, we translated the scale and tested its model fit, model superiority, reliability, and measurement invariance. The eight subscales have also been associated with relevant measures to assess convergent and discriminant validity. Additionally, we investigated the relationship of the individual strategies with relevant self-control outcomes. We confirmed four of our hypotheses fully (H1and H2 (adequacy and superiority of the proposed 8-factor structure), H6 (measurement invariance), and H7 (convergent validity). The remaining five hypotheses were partially confirmed (H3 (item loadings), H4 and H5 (internal consistency and test-retest reliability), H8 (discriminant validity), and H9 (relationship to related outcomes)). Below, we reflect on the three main aims of this project (internal structure and reliability, convergent and discriminant validity, and relationship with self-control outcomes) before discussing further aspects and future avenues.

Aim 1: Internal Structure and Reliability (Measurement Quality Assessment ~~of the German SCSS~~)

The hypothesized eight-factor model with correlated factors for the eight strategies showed good fit and was superior to the alternative one-factor or hierarchical models. This confirms the general structure of the measure. Furthermore, the model was invariant on the

configural, metric, and scalar levels across gender and age groups. This indicates that the scale can be administered across different gender and age groups and can be used to compare means between these groups.

With regard to internal consistency and factors loadings, almost all subscales and items fulfilled our pre-set criteria. One exception was the pre-commitment subscale. Similar to Katzir et al. (2021)'s paper, this subscale was least reliable. In our case, this partially related to one particular item that had a small factor loading and likely reduced the internal consistency. This was the item that was changed the most during the translation process because the original phrasing had no direct equivalent in German. Still, the pre-commitment subscale was predictive of outcomes, thus, the lower internal consistency might also represent an inherent heterogeneity of the strategy. The test-retest reliability of the scale was sufficient, indicating no fundamental reliability problem. For the strategies distraction and cognitive change, on the other hand, test-retest reliabilities were below the pre-set threshold. This might indicate that the use of these strategies varies more over time than others. Regarding the relationship between the individual subscales, most were positively correlated with one another. The exception was the subscale acceptance which showed negative correlations with some of the other scales. This is again consistent with Katzir et al. (2021)'s findings. Possibly, accepting the feeling of being tempted might in general reduce the motivation to enact any strategies to fight the temptation.

Aim 2: Convergent and Discriminant Validity

The SCSS showed plausible associations with related constructs. For example, it explained about 70% of the closely related trait self-control. In line with the results from Katzir et al. (2021), this was largely due to the association with the subscale behavioral inhibition and to a lesser extent pre-commitment. On the other hand, the SCSS was related to, but not considerably overlapping with adjacent constructs such as lay beliefs about willpower or meta-cognition in self-control. The overlap with meta-cognition in self-control was slightly

higher than expected, but was still only half of the association with trait self-control. Possibly, meta-cognition in self-control is a crucial prerequisite for people to implement different self-control strategies and to report their usage. Both of these require basic knowledge about one's own self-control strategy repertoire and implementation. Overall, this indicates that the SCSS captures self-control without tapping too much into related concepts such as beliefs about self-control. Thus, the results suggest that the German version of the SCSS is suitable to assess the use of different self-control strategies in German-speaking populations.

Aim 3: Relationship With ~~Self-Control Strategies~~

~~Comparing the different self-control strategies, the simple correlations suggest that behavioral inhibition, precommitment and cognitive change have the most and strongest relationships to positive self-control outcomes. Once the other strategies were taken into account in the multiple regressions, behavioral inhibition still related to the highest number of outcomes followed by pre-commitment while cognitive change became negligible as a predictor. This is in line with the research by Katzir et al. (2021) who found most associations with behavioral inhibition and pre-commitment. This is good news because previous research put a strong emphasis on behavioral inhibition. Our results show that this focus is not unwarranted. Still, other strategies should be taken into account. Most importantly, pre-commitment had several positive effects on outcomes. Besides, several of the other strategies had effects above behavioral inhibition. Specifically, many specific strategy-outcome combinations emerged. For example, distraction seemed to be helpful for performance on academic exams (as indicated by rank on the university entrance exam). On the other hand, situation selection was positively related to habit strength of physical activity. This indicates that it might be useful to have a broad repertoire of strategies and use them adaptively depending on the context. This is also what other research suggests. Past research showed that having a larger repertoire of self-control strategies available related to more successful goal~~

attainment and management of daily self-control conflicts (Bürgler et al., 2021; Werner, Wu, et al., 2022).

The results also indicate that some strategies might be maladaptive. Punishing oneself for failing to adhere to one's goals was related to more procrastination instead of less, indicating that it might not be a viable strategy in that context. Besides, it was also related to poorer life satisfaction and stronger symptoms of depression and burnout. This indicates that it might not only be inefficient, but also harmful. Such results are a very important starting point for future research. Preventing people from using self-control strategies that are not only ineffective, but also harmful and offering them alternatives would be important.

Self-Control Outcomes

The self-control strategies explained the largest proportion of variance in the outcome that is arguably closest related to self-control, namely procrastination. The strategies explained about one third of the variance between the participants. This is similar to Katzir et al. (2021)'s results that showed the largest amount of explained variance for general self-control failures. Possibly, procrastination and self-control failures would mediate the effect of the self-control strategies on outcomes such as academic achievement or satisfaction with life. Thus, it is plausible that these downstream effects would be smaller.

A considerable amount of variance was also explained in snacking behavior. Interestingly, the corresponding positive behavior "fruit and vegetable intake" showed far less associations with the self-control strategies. This indicates different mechanisms for suppression of unwanted and initiation of wanted behaviors. Possibly, this is partially due to the strong focus of some strategies (e.g., behavioral inhibition) on suppression and not initiation of behaviors.

The self-control strategies also explain some of the more general outcomes, e.g., occupational self-efficacy and life satisfaction. These are possibly consequences of specific behaviors that are themselves influenced by self-control strategies such as procrastination,

snacking or income. Especially, the association with life satisfaction shows the importance of research on self-control and self-control behavior. On the one hand, it indicates that self-control strategies such as behavioral inhibition or pre-commitment may play a role in enhancing life satisfaction. On the other hand, it shows that maladaptive self-control strategies may impair life satisfaction. Thus, supporting people in implementing certain strategies might be fruitful.

The present studies assessed a number of rather objective outcomes that should be less impacted by typical problems of self-reports: students' grades, daily step count, and daily smartphone screen time. Grades were accessed through the university administration. Daily step count and smartphone screen time were collected through uploaded screenshots from existing apps on participants' phones that collect this data. Generally, the proportion of explained variance was smaller in these outcomes (< 10%). This was to be expected because they are influenced by various factors outside people's self-control (e.g., their ability with regard to grades and their job tasks with regard to step count or screen time). Still, some interesting associations emerged, e.g., the use of behavioral inhibition was related to a higher step count and lower screen time. Interestingly, we can also compare the results between objective data (from screenshots) and self-reported data. The results are similar, but not identical which might be surprising given that participants were asked to insert the exact same information from the screenshot. However, some people might have misunderstood the instructions and inserted e.g., data from a different time period while the correct data could be inferred from the screenshot. Others also did not upload a screenshot, but only self-reported their data which could have also led to differences. Regarding grades, none of the strategies showed a significant effect in the multiple regression including all strategies. Partly, this might, however, be due to the smaller number of students (around 100) whose grades we received.

One of the studies assessed pro-environmental behavior as an outcome in line with increasing calls to consider self-control in pro-environmental behavior (Nielsen, 2017). Interestingly, we find that only a small portion of variance in pro-environmental behavior is explained by the self-control strategies. Behavioral inhibition showed the strongest association with pro-environmental behavior, but even this association is small. A possible explanation for this might be that people might not see pro-environmental behavior as a question of self-control (but rather of concern) and, thus, not implement their usual strategies in that context. Another possibility is that people vary more as to whether they want to engage in pro-environmental behavior at all (compared to e.g., health behavior). For people with low importance of pro-environmental behavior, self-control strategies would then not be expected to play a role. However, we did not find an interaction between the importance of pro-environmental behavior and any of the self-control strategies (see supplement for the full results).

Self-Control Strategies

Comparing the different self-control strategies, the simple correlations suggest that behavioral inhibition, precommitment and cognitive change have the most and strongest relationships to positive self-control outcomes. Once the other strategies were taken into account in the multiple regressions, behavioral inhibition still related to the highest number of outcomes followed by pre-commitment while cognitive change became negligible as a predictor. This is in line with the research by Katzir et al. (2021) who found most associations with behavioral inhibition and pre-commitment. This is good news because previous research put a strong emphasis on behavioral inhibition. Our results show that this focus is not unwarranted. Yet, recent discussions raised the concern that the measures of behavioral inhibition are conflated with the assessment of self-control success or ease of behavioral inhibition. This is evident in the SCSS items “I usually manage to control myself from acting on unwanted desires even if they are tempting” and “I find it easy to keep myself from acting

on unwanted desires" . Hence, the measure might not be a pure test of the usage of the strategy "behavioral inhibition" but includes how well people think they are doing in self-control and how good they are at inhibition. This should be considered when using behavioral inhibition scales for self-control assessment. Our supplemental analysis reports the above regression models without behavioral inhibition and shows stronger and more frequent associations of pre-commitment and cognitive change with various outcomes (Bürgler et al., 2022). Still, other strategies should be taken into account. Most importantly, pre-commitment had several positive effects on outcomes. Besides, several of the other strategies had effects above behavioral inhibition. Specifically, many specific strategy-outcome combinations emerged. For example, distraction seemed to be helpful for performance on academic exams (as indicated by rank on the university entrance exam). On the other hand, situation selection was positively related to habit strength of physical activity. This indicates that it might be helpful to have different strategies available for different contexts. Prior research already observed beneficial effects of broader repertoires (Bürgler et al., 2021; Werner, Wu, et al., 2022).

The results also indicate that some strategies might be maladaptive. Punishing oneself for failing to adhere to one's goals was related to more procrastination instead of less, indicating that it might not be a viable strategy in that context. Besides, it was also related to poorer life satisfaction and stronger symptoms of depression and burnout. This indicates that it might not only be inefficient, but also harmful. Such results are a very important starting point for future research. Preventing people from using self-control strategies that are not only ineffective, but also harmful and offering them alternatives would be important. Yet, our results can not give generalizable judgements across all individuals and situations. While we think that punishment is not an advisable strategy in the light of alternatives, we can not rule out that it can be helpful in certain cases.

Mental Health and Personality

We assessed variables of mental health and personality for exploratory analyses. Concerning mental health, we find that behavioral inhibition is related to better mental health, e.g., less symptoms of depression and burnout. Punishment on the other hand is related to poorer mental health in terms of more symptoms of depression and burnout. Prior clinical research further illustrated that self-punishment is a potential risk factor for self-harm (Burke et al., 2021; Burke et al., 2021; Hamza et al., 2014). However, it is important to keep in mind that we cannot speak to the causality of these effects. It is possible that people with certain mental health symptoms are more or less inclined to implement certain self-control strategies. It is also possible that certain strategies lead to certain outcomes (e.g., regarding occupational self-efficacy) which then make people vulnerable to certain symptoms (e.g., of burnout). Bidirectional effects or feedback loops are conceivable as well.

With regard to personality, the BIG-5 facet conscientiousness showed the strongest connections to the self-control strategies (specifically, behavioral inhibition and pre-commitment). This is not surprising as conscientiousness is related to aspects such as being organized or goal-directed and has previously been connected to self-control (Tangney et al., 2004). Besides, behavioral inhibition and acceptance are related to other personality facets. For example, neuroticism is related to lower use of acceptance, while openness is related to higher use. These results indicate that the use of certain strategies might be influenced by people's personality. This is in line with past research showing associations between personality and self-control (Pilarska, 2018).

Limitations & Future Research

The current project offers multiple avenues for future advances. Given the length of the current SCSS, the development of a language invariant short-scale should be a central target of future advances. This would not only allow a more economic assessment of self-control

strategies but is required to make valid advances towards state-oriented research (e.g., ecological assessments).

Given the insights from the above described studies, the application of clustering methods appears as a second, valuable direction of hypothesis generation. Evidently, some strategies are mostly relevant in terms of their maladaptive relationship to several outcomes (e.g., more punishment related to less satisfaction with life). From our perspective, there is potential for different repertoire constellations in self-control strategies. These might be informative for future work, especially through targeted interventions, strengthening specific strategies (e.g., reduction of punishment as strategy). Yet, the current data can not rule out potential situations, in which the strategy might be non-maladaptive or adaptive.

Third, further translation and validation work is needed, assessing the degree of inter-cultural generalizability of the SCSS. From our perspective, it appears likely that the usage of strategies varies across cultural dimensions and that there could be additional strategies, limited to specific cultural spheres.

Last, we argue that future advances in self-control research, especially in applied research, should incorporate measures of habit strength rigorously. As supported by the current study, habit strength plays a crucial role in understanding behavior and could be a potential blind spot, when left out. Similar arguments were made recently by Saunders and More (2024), who reported that habitual behaviors and self-regulation strategies are positively related.

In the present studies, we assessed the use of the self-control strategies across contexts. Specifically, participants were asked to report to what extent they agree with the individual items across different situations (e.g., work, health or consumption). However, there might be relevant differences between situations, e.g., people might use distraction at work, but opt for pre-commitment in their private life. Some participants also indicated in the open comment fields at the end of the study that they found it difficult to report a general tendency because

their behavior differs considerably between situations. Thus, in the future it might be beneficial to assess the self-control strategies with regard to specific contexts. This would allow for more precise estimates of which strategies are helpful in which context. This is supported by recent theoretical advances, pointing out the so called fallacy of uniform efficacy (Bonanno & Burton, 2013) in which researchers assume general distinctions of strategies in adaptive and maladaptive over time and context. Similar arguments were made in the field of self-control more specifically (Werner & Ford, 2023).

All studies reported in this paper were correlational. Thus, they speak to whether people that use certain strategies more frequently achieve certain outcomes. However, the underlying causal relationship is unclear. Future research may try to teach participants certain strategies to investigate causal effects on the outcomes. Especially with regard to mental health outcomes (e.g., depressive, burnout and ADHD symptoms), it is unclear whether some strategies make people vulnerable to those symptoms (possibly mediated by other self-control outcomes) or whether those mental health symptoms make certain strategies easier or harder to apply. For example, the association between ADHD symptoms and behavioral inhibition most likely just reflects the inherent criteria of ADHD.

Conclusion

Considering the above described results, the SCSS appears to be a mostly valid and reliable measure, which can be used in German. Further, it can be used for valid group comparisons by gender and age, when considering the boundaries of our analytical scope. Also, it is associated with a range of relevant outcomes with considerable amounts of explained variance. While further research on many ends is needed, this manuscript offers a starting point for many further avenues, related to self-control strategies on the conceptual and applied level.

Author Contributions

Competing Interests

The authors declare no conflict of interests. The work is supported by the Support Scholarship by the Austrian Federal Ministry of Education, Science and Research, awarded through the University of Vienna to Victoria Wagner, Artemis L. Nordmann, Loana-Corine Stenzel and Olga Freiman.

Ethic Approvement

The study was approved by the Departmental Review Board (DRB) of the Faculty of Psychology, Department of Occupational, Economic, and Social Psychology (2023/M/009).

References

Akaike, H. (1974). A new look at the statistical model identification problem. *IEEE Trans. Autom. Control*, *19*, 716.

Allemand, M., Job, V., & Mroczek, D. K. (2019). Self-control development in adolescence predicts love and work in adulthood. *Journal of Personality and Social Psychology*, *117*(3), 621–634. https://doi.org/10.1037/pspp0000229

Allemand, M., Steiger, A. E., & Fend, H. A. (2015). Empathy Development in Adolescence Predicts Social Competencies in Adulthood. *Journal of Personality*, *83*(2), 229–241. https://doi.org/10.1111/jopy.12098

Ariely, D., & Wertenbroch, K. (2002). Procrastination, Deadlines, and Performance: Self-Control by Precommitment. *Psychological Science*, *13*(3), 219–224. https://doi.org/10.1111/1467-9280.00441

Awang, Z. (2012). A handbook on SEM. *Structural Equation Modeling*.

Bernecker, K., & Job, V. (2015). Beliefs About Willpower Are Related to Therapy Adherence and Psychological Adjustment in Patients With Type 2 Diabetes. *Basic and Applied Social Psychology*, *37*(3), 188–195. https://doi.org/10.1080/01973533.2015.1049348

Bernecker, K., & Job, V. (2017). Implicit Theories About Willpower in Resisting Temptations and Emotion Control. *Zeitschrift Für Psychologie*, *225*(2), 157–166. https://doi.org/10.1027/2151-2604/a000292

Bernecker, K., & Job, V. (2020). Too exhausted to go to bed: Implicit theories about willpower and stress predict bedtime procrastination. *British Journal of Psychology*, *111*(1), 126–147. https://doi.org/10.1111/bjop.12382

Bertrams, A., & Dickhäuser, O. (2009). Messung dispositioneller Selbstkontroll-Kapazität: Eine deutsche Adaptation der Kurzform der Self-Control Scale (SCS-K-D). *Diagnostica*, *55*(1), 2–10. https://doi.org/10.1026/0012-1924.55.1.2

Bonanno, G. A., & Burton, C. L. (2013). Regulatory Flexibility: An Individual Differences Perspective on Coping and Emotion Regulation. *Perspectives on Psychological Science*, *8*(6), 591–612. https://doi.org/10.1177/1745691613504116

Brevers, D., & Turel, O. (2019). Strategies for self-controlling social media use: Classification and role in preventing social media addiction symptoms. *Journal of Behavioral Addictions*, *8*(3), 554–563. https://doi.org/10.1556/2006.8.2019.49

Bujang, M. A., & Baharum, N. (2017). A simplified guide to determination of sample size requirements for estimating the value of intraclass correlation coefficient: A review. *Archives of Orofacial Science*, *12*(1).

Bürgler, S., Hoyle, R. H., & Hennecke, M. (2021). Flexibility in using self-regulatory strategies to manage self-control conflicts: The role of metacognitive knowledge, strategy repertoire, and feedback monitoring. *European Journal of Personality*, *35*(6), 861–880. https://doi.org/10.1177/0890207021992907

Bürgler, S., Kleinke, K., & Hennecke, M. (2022). The Metacognition in Self-Control Scale (MISCS). *Personality and Individual Differences*, *199*, 111841. https://doi.org/10.1016/j.paid.2022.111841

Burke, T. A., Fox, K., Kautz, M. M., Rodriguez-Seijas, C., Bettis, A. H., & Alloy, L. B. (2021). Self-Critical and Self-Punishment Cognitions Differentiate Those With and Without a History of Nonsuicidal Self-Injury: An Ecological Momentary Assessment Study. *Behavior Therapy*, *52*(3), 686–697. https://doi.org/10.1016/j.beth.2020.08.006

Burke, T. A., Fox, K., Kautz, M., Siegel, D. M., Kleiman, E., & Alloy, L. B. (2021). Real-time monitoring of the associations between self-critical and self-punishment cognitions and nonsuicidal self-injury. *Behaviour Research and Therapy*, *137*, 103775. https://doi.org/10.1016/j.brat.2020.103775

Büssing, A., & Perrar, K.-M. (1992). Die Messung von Burnout. Untersuchung einer deutschen Fassung des Maslach Burnout Inventory (MBI-D). [Measuring burnout: A

study of a German version of the Maslach Burnout Inventory (MBI-D).]. *Diagnostica*, *38*(4), 328–353.

Byrne, B. M. (1994). *Structural Equation Modeling with EQS and EQS/WINDOWS: Basic Concepts, Applications, and Programming*. SAGE.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed). L. Erlbaum Associates.

de Ridder, D. T. D., Lensvelt-Mulders, G., Finkenauer, C., Stok, F. M., & Baumeister, R. F. (2012). Taking Stock of Self-Control: A Meta-Analysis of How Trait Self-Control Relates to a Wide Range of Behaviors. *Personality and Social Psychology Review*, *16*(1), 76–99. https://doi.org/10.1177/1088868311418749

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction With Life Scale. *Journal of Personality Assessment*, *49*(1), 71–75. https://doi.org/10.1207/s15327752jpa4901_13

Duckworth, A. L., Gendler, T. S., & Gross, J. J. (2016). Situational Strategies for Self-Control. *Perspectives on Psychological Science*, *11*(1), 35–55. https://doi.org/10.1177/1745691615623247

Duckworth, A. L., Taxer, J. L., Eskreis-Winkler, L., Galla, B. M., & Gross, J. J. (2019). Self-Control and Academic Achievement. *Annual Review of Psychology*, *70*(1), 373–399. https://doi.org/10.1146/annurev-psych-010418-103230

Duckworth, A. L., White, R. E., Matteucci, A. J., Shearer, A., & Gross, J. J. (2016). A stitch in time: Strategic self-control in high school and college students. *Journal of Educational Psychology*, *108*(3), 329–341. https://doi.org/10.1037/edu0000062

Epskamp, S., & Fried, E. (2017). A Tutorial on Regularized Partial Correlation Networks. *Psychological Methods*, *23*. https://doi.org/10.1037/met0000167

Fujita, K. (2011). On Conceptualizing Self-Control as More Than the Effortful Inhibition of Impulses. *Personality and Social Psychology Review*, *15*(4), 352–366.

https://doi.org/10.1177/1088868311411165

Gardner, B., Abraham, C., Lally, P., & De Bruijn, G.-J. (2012). Towards parsimony in habit measurement: Testing the convergent and predictive validity of an automaticity subscale of the Self-Report Habit Index. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 102. https://doi.org/10.1186/1479-5868-9-102

Glaesmer, H., Grande, G., Braehler, E., & Roth, M. (2011). The German Version of the Satisfaction With Life Scale (SWLS): Psychometric Properties, Validity, and Population-Based Norms. *European Journal of Psychological Assessment*, *27*(2), 127–132. https://doi.org/10.1027/1015-5759/a000058

Hamza, C. A., Willoughby, T., & Armiento, J. (2014). A laboratory examination of pain threshold and tolerance among nonsuicidal self-injurers with and without self-punishing motivations. *Archives of Scientific Psychology*, *2*(1), 33–42. https://doi.org/10.1037/arc0000008

Hassebrauck, M. (1991). ZIP - Ein Instrumentarium zur Erfassung der Zufriedenheit in Paarbeziehungen. *Zeitschrift Für Sozialpsychologie*, *22*, 256–259.

Hendrick, S. S. (1988). A Generic Measure of Relationship Satisfaction. *Journal of Marriage and Family*, *50*(1), 93–98. https://doi.org/10.2307/352430

Hofmann, W., Adriaanse, M., Vohs, K. D., & Baumeister, R. F. (2014). Dieting and the self-control of eating in everyday environments: An experience sampling study. *British Journal of Health Psychology*, *19*(3), 523–539. https://doi.org/10.1111/bjhp.12053

Inzlicht, M., & Friese, M. (2021). Willpower is overrated. *Behavioral and Brain Sciences*, *44*, e42. https://doi.org/10.1017/S0140525X20000795

Job, V., Dweck, C. S., & Walton, G. M. (2010). Ego Depletion—Is It All in Your Head?: Implicit Theories About Willpower Affect Self-Regulation. *Psychological Science*, *21*(11), 1686–1693. https://doi.org/10.1177/0956797610384745

Kaiser, F. G. (2020). *GEB-50. General Ecological Behavior Scale*.

https://doi.org/10.23668/PSYCHARCHIVES.3453

Katzir, M., Baldwin, M., Werner, K. M., & Hofmann, W. (2021). Moving beyond Inhibition: Capturing a Broader Scope of the Self-Control Construct with the Self-Control Strategy Scale (SCSS). *Journal of Personality Assessment*, *103*(6), 762–776. https://doi.org/10.1080/00223891.2021.1883627

Kessler, R. C., Adler, L., Ames, M., Demler, O., Faraone, S., Hiripi, E., Howes, M. J., Jin, R., Secnik, K., Spencer, T., Ustun, T. B., & Walters, E. E. (2005). The World Health Organization adult ADHD self-report scale (ASRS): A short screening scale for use in the general population. *Psychological Medicine*, *35*(2), 245–256. https://doi.org/10.1017/S0033291704002892

Kroese, F. M., De Ridder, D. T. D., Evers, C., & Adriaanse, M. A. (2014). Bedtime procrastination: Introducing a new area of procrastination. *Frontiers in Psychology*, *5*. https://www.frontiersin.org/articles/10.3389/fpsyg.2014.00611

Kyriazos, T. A. (2018). Applied Psychometrics: Sample Size and Sample Power Considerations in Factor Analysis (EFA, CFA) and SEM in General. *Psychology*, *9*(8), Article 8. https://doi.org/10.4236/psych.2018.98126

Lange, F., & Dewitte, S. (2019). Measuring pro-environmental behavior: Review and recommendations. *Journal of Environmental Psychology*, *63*, 92–100. https://doi.org/10.1016/j.jenvp.2019.04.009

Löwe, B., Spitzer, R. L., Zipfel, S., & Herzog, W. (2002). *PHQ-D: Gesundheitsfragebogen für Patienten; Manual Komplettversion und Kurzform*. Pfizer GmbH.

Martin, A., Rief, W., Klaiberg, A., & Braehler, E. (2006). Validity of the Brief Patient Health Questionnaire Mood Scale (PHQ-9) in the general population. *General Hospital Psychiatry*, *28*(1), 71–77. https://doi.org/10.1016/j.genhosppsych.2005.07.003

Maslach, C., Jackson, S. E., & Leiter, M. P. (1997). Maslach Burnout Inventory: Third edition. In *Evaluating stress: A book of resources* (pp. 191–218). Scarecrow

Education.

Milyavskaya, M., Saunders, B., & Inzlicht, M. (2021). Self-control in daily life: Prevalence and effectiveness of diverse self-control strategies. *Journal of Personality*, *89*(4), 634–651. https://doi.org/10.1111/jopy.12604

Mischel, W., & Baker, N. (1975). Cognitive appraisals and transformations in delay behavior. *Journal of Personality and Social Psychology*, *31*(2), 254–261. https://doi.org/10.1037/h0076272

Mischel, W., Ebbesen, E. B., & Raskoff Zeiss, A. (1972). Cognitive and attentional mechanisms in delay of gratification. *Journal of Personality and Social Psychology*, *21*(2), 204–218. https://doi.org/10.1037/h0032198

Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., Houts, R., Poulton, R., Roberts, B. W., Ross, S., Sears, M. R., Thomson, W. M., & Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences*, *108*(7), 2693–2698. https://doi.org/10.1073/pnas.1010076108

Nielsen, K. S. (2017). From prediction to process: A self-regulation account of environmental behavior change. *Journal of Environmental Psychology*, *51*, 189–198. https://doi.org/10.1016/j.jenvp.2017.04.002

Paluch, A. E., Bajpai, S., Bassett, D. R., Carnethon, M. R., Ekelund, U., Evenson, K. R., Galuska, D. A., Jefferis, B. J., Kraus, W. E., Lee, I.-M., Matthews, C. E., Omura, J. D., Patel, A. V., Pieper, C. F., Rees-Punia, E., Dallmeier, D., Klenk, J., Whincup, P. H., Dooley, E. E., … Fulton, J. E. (2022). Daily steps and all-cause mortality: A meta-analysis of 15 international cohorts. *The Lancet Public Health*, *7*(3), e219–e228. https://doi.org/10.1016/S2468-2667(21)00302-9

Pilarska, A. (2018). Big-Five personality and aspects of the self-concept: Variable- and person-centered approaches. *Personality and Individual Differences*, *127*, 107–113.

https://doi.org/10.1016/j.paid.2018.01.049

Rammstedt, B., & Danner, D. (2017). Die Facettenstruktur des Big Five Inventory (BFI): Validierung für die deutsche Adaptation des BFI. *Diagnostica*, *63*(1), 70–84. https://doi.org/10.1026/0012-1924/a000161

Rammstedt, B., Kemper, C. J., Céline, M., Beierlein, C., & Kovaleva, A. (2013). 10 Item Big Five Inventory. *S. S.*, 17.

Rigotti, T., Schyns, B., & Mohr, G. (2008). A Short Version of the Occupational Self-Efficacy Scale: Structural and Construct Validity Across Five Countries. *Journal of Career Assessment*, *16*(2), 238–255. https://doi.org/10.1177/1069072707305763

Saunders, B., & More, K. R. (2024). Some habits are more work than others: Deliberate self-regulation strategy use increases with behavioral complexity, even for established habits. *Journal of Personality*, *n/a*(n/a). https://doi.org/10.1111/jopy.12926

Steel, P. (2010). Arousal, avoidant and decisional procrastinators: Do they exist? *Personality and Individual Differences*, *48*(8), 926–934. https://doi.org/10.1016/j.paid.2010.02.025

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High Self-Control Predicts Good Adjustment, Less Pathology, Better Grades, and Interpersonal Success. *Journal of Personality*, *72*(2), 271–324. https://doi.org/10.1111/j.0022-3506.2004.00263.x

Werner, K. M., & Ford, B. Q. (2023). Self-control: An integrative framework. *Social and Personality Psychology Compass*, *17*(5), e12738. https://doi.org/10.1111/spc3.12738

Werner, K. M., Inzlicht, M., & Ford, B. Q. (2022). Whither Inhibition? *Current Directions in Psychological Science*, *31*(4), 333–339. https://doi.org/10.1177/09637214221095848

Werner, K. M., Wu, R., Gross, J., & Friese, M. (2022). *When Bigger is Better: Size of Strategy Repertoire Predicts Goal Attainment* [Preprint]. PsyArXiv. https://doi.org/10.31234/osf.io/5uvxg

WHO guidelines on physical activity and sedentary behavior. (2020). WHO.