How does self-control develop throughout the week?

An Experience Sampling Design

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Abstract

Background. Self-control is a valuable trait that plays an important role in acquiring positive outcomes in life as well as avoiding negative ones. However, the distinction between self-control as a trait (TSC) and as a state (SSC) has not been studied separately very often. The influence of a decrease in SSC due to previous activities (ego depletion) has mostly been studied for a short period. Therefore, this study makes a start by examining TSC and SSC separately in a longitudinal design, this in-depth method can capture the fluctuations of SSC and provide insight into the self-control of respondents.

Objective. This research aims to examine the relationship between TSC and SSC. The development of SSC in particular and a possible effect of the day of the week is assessed, with an emphasis on the role of ego depletion and inhibitory self-control. The sample contained students who were 18 years or older.

Method. An experience-based sampling method (ESM) was implemented to form a study examining self-control with a duration of fifteen days total in April 2020. The 37 respondents (M_{age} = 22) consisted of 24 women and 13 men. To measure TSC, the Brief Self-control Scale (BSCS) was utilized and was taken once each week resulting in two measurements. For SSC, a scale was constructed based on a combination of ego depletion and previous literature, it was filled out three times a day resulting in 45 measurements. Respondents were asked to fill in questionnaires via their smartphones using the Ethica application. After this, Linear Mixed Models analyses were performed to measure between-person and within-person effects for TSC and SSC.

Results. There was an association found between TSC and SSC (B= .40, p<.001, 95% CI [.30, .50]), this relationship is not influenced by the weekend/workdays (B= .06, p.73, 95% CI [-.26, .37]). The relationship between ego depletion and inhibition was also found in an uncontrolled environment (B= .19, p<.001, 95% CI [.14, .24]) although it is only weakly correlated. The results also showed that the higher the levels of either inhibitory self-control and/or goal-oriented behavior are, the higher levels of ego depletion an individual experiences (B= .32, p<.001, 95% CI [.26, .37]).

Conclusion. A moderately strong association was found between TSC and SSC, meaning that TSC is associated with SSC and how it plays a role in daily behavior. Results also showed that the day of the week does not influence someone's level of SSC. It was observed that when someone reports high levels of goal-directed behavior and/or inhibiting impulses, their levels of ego depletion are also high. This was one of the first studies where ego depletion was observed in an uncontrolled setting. Follow-up studies can focus on: (1) an ESM design that provides respondents the opportunity to describe activities (2) a more diverse sample (3) repeating similar research when there is no pandemic.

Introduction

Which trait is the most essential to live a meaningful and satisfying life? Next to intelligence, which predicts possible helpful factors such as job performance and academic achievement (Hambrick, 2015), the answer to this may be self-control. Self-control is the capacity to restrict one's impulses and desires (Baumeister, 2012). It includes an 'active self' that can distinguish between long-term and short-term goals and prioritizes the benefits in the long run over immediate gratification (Baumeister et al. 1998). It is associated with several desirable outcomes in life, for example, higher academic achievements, more interpersonal success, and less maladaptive adjustments (Tangney et al., 2004). More recent findings suggest that people who possess self-control, experience a greater feeling of life satisfaction and better health (Cheung et al., 2014). Although the benefits of self-control are far-reaching, we know little about how it fluctuates in daily life.

Self-control may be more necessary than merely a desired trait. For example, a lack of it predicts early mortality (Kern & Friedman, 2008), engagement in unhealthy behaviors like overeating, and noncompliance with medical regimens (Bogg & Roberts, 2004). In addition to this, a reduced capacity to exert self-control is an underlying factor that is responsible for problems such as difficulties with impulse control (Vaughn et al., 2008). These difficulties predict criminal offenses, substance abuse, and a variety of psychiatric disorders. Hence, self-control can be regarded as an influential trait, both in prosocial and antisocial outcomes (Vaughn et al., 2008). Still, there is much unclear about the construct of self-control. It is uncertain if some people simply have more self-control (trait), or these results are influenced because at times it is easier to apply self-control (state). Variations in self-control have been studied mainly as a short experiment in a controlled environment (Hagger et al., 2010), but it remains unclear how it develops in the outside world. Hence, this study will examine this further. An important distinction is to differentiate between trait self-control (TSC) and state self-control (SSC).

1.1 Difference between TSC and SSC

When a quality is discussed, it is of importance to differentiate between it being a trait that refers to a more stable characteristic or behavior (Clifford, 2017) and a state which tends to be more of a temporary way of being (Lazarus, 2017). Individuals who are high in self-control as a trait, can successfully avoid temptations, rather than merely resisting them (Ent et al., 2015). The ability to apply self-control strategies varies among individuals, some individuals are more equipped to regulate themselves than others. The capacity to self-regulate seems to remain constant across the lifespan (Gailliot et al., 2012). Self-control as a state, however, fluctuates within an individual. One may be able to regulate themselves more (or less) at different moments in time (Gailliot et al., 2012). For example, an individual can be high in self-control as a trait yet still struggle to only eat two cookies

instead of the entire package when feeling tired after a long day of work. In most studies where self-control was examined, they only focused on this concept as a trait disregarding all the fluctuations (states) possible within an individual. Even if there was attention for SSC, it focused merely on the consequences of momentary effortful inhibition (Ridder et al. 2017). The initiation of attempts at the pursuit of goals is an additional important component of self-control according to Ridder & Gillebaart (2016). This underlines that SSC has more aspects than only effortful inhibition. The concept of goal pursuit is often not included in studies examining self-control. Ridder & Gillebaart (2016) argue that the underlying process of goal attainment is responsible for the link between self-control and well-being. To the author's knowledge, only one recent study by Guan & He (2018) examined SSC separately from TSC. They found that individuals with high TSC show greater and more stable SSC abilities than those who score lower. People who score low on the TSC were also more affected by the difficulty of a demanding (in other words depleting) task. Thus, it is possible to differentiate between the two concepts TSC and SSC. To fully grasp the scope of the construct of self-control as a whole, this study will focus on both TSC and SSC because they are connected.

1.2 Ego depletion

The levels of self-control of an individual can get depleted and restored. SSC is more reactive and thus more vulnerable to external factors than TSC. In his review, Baumeister defines self-control as a muscle that can get fatigued but can also grow stronger via exercise. He refers to this as the Strength Model of Self-control (Baumeister et al., 2007). Ego depletion is part of this model: it is the notion that self-control is a limited resource (Baumeister et al. 1998). When it is drained, the mental activity needed to inhibit an impulse is affected (Baumeister, 2012). Following the Strength Model, SSC is considered susceptible to, among other things, situational influences such as self-control exerted earlier. The existence of ego depletion has been demonstrated in many settings (Baumeister et al., 1998; Baumeister et al., 2006; Muraven et al., 2006; Hagger et al., 2010). These studies focussed predominately on ego depletion and the differences between persons, questions about within-person fluctuation were not asked and are yet to be investigated. Additionally, the studies take almost solely place in a controlled setting within a limited timeframe. If and how long the ego depletion effect can be observed in the real world remains unclear.

1.3 Monitoring self-control

The variations in self-control as a state have been studied mainly as a short experiment in a controlled environment. Current literature has trouble providing a satisfactory answer to how self-control develops over longer periods, using a broader definition than only ego depletion. The design often is centered around the laboratory and often focuses on merely ego depletion. Additionally, the majority of studies use quite a simple design (Carter & McCullough, 2014) that does not accurately represent

challenges people face in daily life. Examples of such designs are by: Salmon et al. (2014); Inzlicht & Schmeichel (2012), (Guan & He, 2018) and Baumeister et al. (1998). Implementing a short depleting task was often applied, such as trying to solve an unsolvable puzzle (Guan & He, 2018). The problem with this straightforward design, however, is that it does not take into account factors that may influence SSC in daily life, such as place, mood, the amount/quality of sleep, the social situation, or what day it is of the week. The lack of consideration of these factors is underlined by the inability to replicate the ego-depletion effect outside of the laboratory (de Ridder et al., 2017).

1.4 Critical view on ego-depletion

The problems with observing the ego depletion effect in the 'real world' have led to major criticism of the paradigm (Lurquin & Miyake, 2017). It was commonly regarded as a limited resource, but because of the problems with replication, it is not entirely clear to which extent self-control exerted earlier, affects the amount of self-control available later on (Psychology Today, n.d.). Whilst reanalyzing the meta-analysis by Hagger et al. (2010), controlling for small effect sizes, it was found that the effect sizes were no longer significant (Carter & McCullough, 2014). Although Hagger & Chatzisarantis (2014) were critical of these conclusions at first, they later confirm that the effect of ego depletion is close to zero upon closer examination (Hagger et al. 2016). Francis et al. (2018) also found inconsistent results when studying ego depletion. The depletion effect was not consistent in affecting the behavioral self-control of respondents. Francis and colleagues (2018) did, however, find evidence for the depletion effect itself. Nevertheless, they conclude that previous measures of the depletion effect are overstated and the effect is possibly moderated by characteristics of the task and the differences between individuals (Francis et al., 2018). Since much of the research on ego depletion focus on short experiments executed on the same day, there potentially lies a great deal of information in examining data collected in a study of a more longitudinal nature. Examining this may shed a light on how long this proposed effect persists in a natural setting.

1.5 Self-control throughout the week

Not much is known about how SSC varies over time. A possible distinction that could be made is between the workweek and the weekend. Presumably, weekends are for engaging in activities that help in relieving stress. Based on the desire to relieve tiredness from job activities, weekend activities are voluntary (Jeong et al., 2020). Levels of SSC could potentially dip during the weekend when individuals might be exposed to more temptations than in a work or study environment and with fewer responsibilities taking up their time. For example, letting go of responsible behavior starting on Friday night all through the weekend. A different viewpoint might be that there is a peak of SSC during the weekend. When someone engages in family obligations even though they would prefer relaxing

activities at home. Although these examples are speculative, how individuals spend their weekends can affect self-regulatory capacities (Baumeister et al., 1998). The relevance of examining whether there is a possible effect of the weekend on the subsequent workweek is demonstrated by Fritz et al. (2010). They found that the way employees spend their weekends may be important to their affective states during that subsequent workweek. When there is insufficient recovery during the weekend, particularly for longer periods, this has an impact on an individual's health (Fritz et al., 2010). In addition to this, engaging in recovering activities during the weekend is seen as an important factor in reducing the effects of (task-related) stressors according to Ragsdale et al. (2011). In which the weekend could potentially act as a buffer for the following workweek. Jeong et al. (2020) argue that the higher the level of recovery experience is, the bigger the effect of weekend activities is on psychological well-being. These studies highlight the possibility for the behavior on the weekend to affect the behavior of the following week. The question that arises is whether this could also be the case for self-control. If there is an effect of previously exercised self-control on the weekend and whether this still has any influence in the subsequent working week or vice versa.

1.6 Aim of this study

Even though there are problems with replicating previous research on ego depletion, Wenzel et al. (2020) do argue it should not prevent researchers from further investigating self-control. It does however require attention to find a more refined approach to examining this concept. As discussed, the effects of ego depletion are smaller than initially thought. The common methodology that was implemented – a between-subject design- might not be sufficient to uncover effects (Francis et al., 2018). Therefore, it may be more fruitful to implement a within-subject design such as Experience Sampling Methodology (ESM) to paint a clearer picture of the differences in SSC throughout the day. Francis et al. (2018) highlight that when studying the effects of ego depletion, ESM may be a worthwhile approach. Within the research of self-control in general, ESM is a method that seems to get more attention (Hoffman et al., 2013; Zhang et al., 2018; Baumeister et al., 2018; Zhou et al., 2021). Therefore, it is also applied in the current study.

Through ESM, the study examines how self-control develops in an uncontrolled setting with a longitudinal nature. The following research questions arise from this:

How does self-control develop during the week?

1. *To what extent is trait self-control (TSC) associated with state self-control (SSC)?*
2. *To what extent is this relationship different on weekdays versus weekend days?*
3. *To what extent do weekdays/weekend days influence SSC?*
4. *To what extent does inhibitory self-control predict ego depletion?*

Method

2.1 Design

A measure that lends itself well to illustrate the variations within these processes validly is through ESM (Csikszentmihalyi & Larson, 2014). ESM targets measuring the behavior, thoughts, and feelings of respondents during their daily activities (van Berkel, 2018). The gathered data documents the variability in their daily behavior and the different states they find themselves in (Csikszentmihalyi & Larson, 2014). The main factor that differentiates ESM from other designs is that the gathered data is in a natural environment. Because the repeated-measures design makes more data available due to the multiple measurements, the statistical power is improved. This allows the researchers to be more assured in their results because of the increased sensitivity (Francis et al, 2018). In addition, using a within-subject design creates a situation where the respondents that are participating also function as their own control group. This results that the data can be compared to earlier entries of the same respondent, which is beneficial to removing between-subject variation (Francis et al, 2018).
ESM is an ideal empirical method to fully understand and describe respondents' day-to-day experiences of exercising self-control (van Berkel, 2018). Because ESM uses daily surveys, it is a method that strengthens the ecological validity of this research, which helps tackle one of the limitations of existing ego depletion research, the generalizability of the results.

2.2 Respondents

The current study uses data that was previously collected in an ESM study on trait and state self-control (Bagala, 2021). The respondents in this study were contacted by researchers using convenience method sampling as well as snowball sampling. The original sample contained 61 university students. The inclusion criteria to participate in this study were: being 18 years or older and being in the possession of a smartphone. Due to a technical error, 20 respondents did not have the opportunity to give informed consent, therefore this data cannot be used. Also, data is only included if the response rate was 50% or higher, a cut-off score in line with common practice (Connor & Lehman, 2012). The last exclusion criterium was that respondents had to have filled out at least one entry of the weekly survey on TSC.

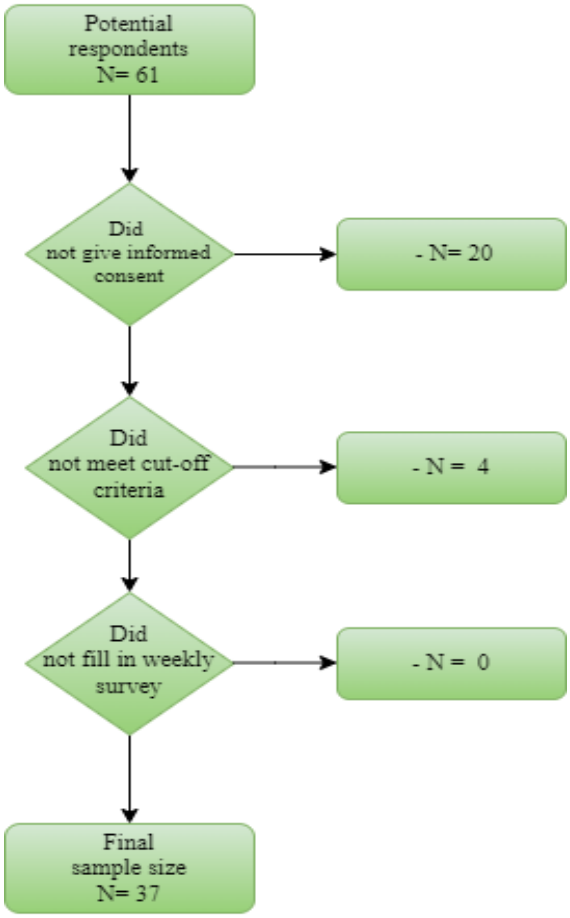

Figure 1. Flow diagram respondents

2.3 Materials

To ensure that the daily surveys were short and achievable for respondents to complete in a few minutes, SSC and TSC were split into two measurements. SSC was measured daily and TSC weekly. Respondents had to complete seven questions of the survey measuring SSC (Table 1). In the weekly survey respondents were asked to fill in thirteen questions about TSC (Appendix A).

Sociodemographic

The sociodemographic details that were asked of the respondents were their occupation, age, gender, and nationality.

Daily measures

To offer a broad view of the SSC of respondents, three subscales were utilized. Ego depletion, inhibitory self-control, and goal-directed behavior. The response option is a five-point Likert scale that ranges from 0 (not at all) to 4 (very much). The complete overview of the items can be found in Table 1. Ego depletion was measured with three items derived from the Self Control Scale (Tangey, 2004). This is a self-report questionnaire that assesses different aspects of self-control. It is one of the foremost questionnaires applied in psychological research (Kwapis & Bartczuk, 2020) since its

reliability is high α = .89 (Unger et al. 2018). Using only three items made it suitable as a daily measure in an ESM design. However, for composing the other two subscales, goal-directed self-control, and inhibitory self-control, the work of Tornquist & Miles (2019) and Simons et al. (2016) was used. Tornquist & Miles (2019) define goal-directed self-control as the skill of persisting in difficult, disliked, and/or uninteresting activities to achieve a goal. Based on this, the two items measuring goal-directed behavior were composed (see Table 1). De Ridder et al. (2011), argue that inhibitory self-control is a predictor of undesired behavior, therefore this concept was included in this questionnaire. Based on the work of Simons et al. (2016), two items were formed to measure this (see Table 1). Forming the questionnaires was done by other researchers (Bagala, 2021).

Weekly measures

To measure TSC the Brief Self-Control Scale was used (Tangey et al. 2004). This is the shorter version of the Self Control Scale, it is designed to concentrate on the behavioral aspects of self-control, such as breaking with unwanted habits (Tangey et al. 2004). The scale consists of 13 items, for example, *"I often act without thinking through all the alternatives"* and *"People would say that I have iron self-discipline"*. The Brief Self-Control Scale is a well-validated instrument that is commonly applied (Duckworth & Kern, 2011), with high reliability (α = .89) (Manapat et al., 2019). The test-retest reliability is also high (α = .87) (Tangney et al. 2004). This makes it suitable for this study because where the same measures are evaluated at different points in time. For the whole questionnaire see Appendix A.

Table 1

Items state questionnaire

Construct		Item
Self-Control	Ego depletion	1. In the past couple of hours, have you felt that it is hard to make up your mind about even simple things?*
		2. In the past couple of hours, have you felt that things are bothering you more than they usually would?*
		3. In the past couple of hours, have you felt that you have less mental and emotional energy than you normally have?*
	Goal-directedness	4. In the past couple of hours, how easy was it for you to do something "good" that you did not really want to do (e.g. eating healthy food)?

		5. In the past couple of hours, were you able to stick to your goals?
	Inhibitory self-control	6. In the past couple of hours, how easy was it for you to refrain from doing something “bad” you really wanted to do (e.g. snacking)?
		7. In the past couple of hours, were you able to resist temptations?

Note. *Items with reversed coding

2.4 Procedure

Data collection

ESM enables researchers to understand how self-control is exerted in daily life. Given the opportunity to measure the different states a respondent finds themselves in during the day, it provides insight into behavior and thoughts as they are happening at that moment. This also minimizes the problem of retrospective bias (Myin-Germeys et al., 2018) and increases the capacity of studying the phenomenon in a natural setting, which increases the ecological validity (van Berkel, 2018) and therefore supports the generalizability of the results. To measure the fluctuations in SSC, an ESM design was employed (Figure 1). The data was collected over fifteen days during April and May 2021 using the Ethica app installed on respondents' smartphones. Ethica is a cross-platform solution that allows collecting qualitative and quantitative data through monetary questionnaires that are sent directly to the participant’s smartphone (Menchaca, 2020). Through Ethica, respondents also provided informed consent. The app sent respondents reminders via notifications on their devices to complete the daily/weekly measurements at the desired times. The first notification was sent in the morning between 9 and 11 a.m. In the afternoon, the second questionnaire was sent between 1 and 3 p.m. The last notification was between 8 and 10 p.m. If the respondent did not register their response, a reminder was sent after 30 minutes. If there still was no answer registered, the option to do so expired after one hour. This was set up in this manner to ensure that the data was collected at that particular moment of the day, following a contingent sampling design, where respondents are asked to complete the questionnaire at regular intervals (Myin-Germeys et al., 2018).

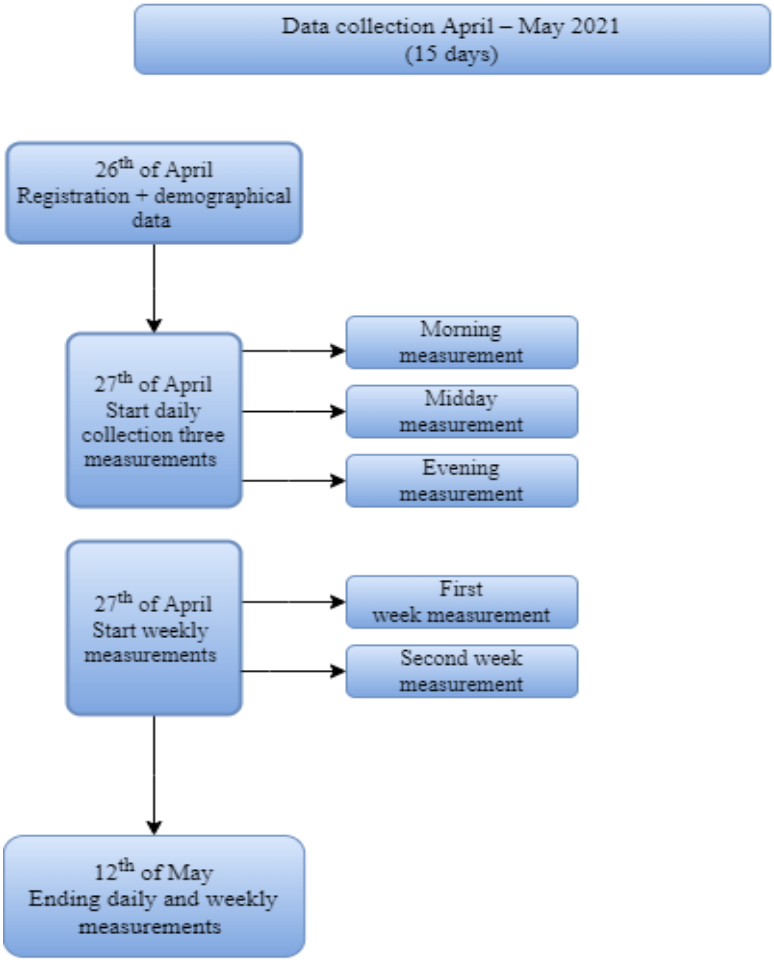

Figure 1. Timeline and elements of the data collection.

Suitability of the data

The data used in this study was found suitable for several reasons. The first one was that it is recently collected, April-May 2021, therefore the phenomenon that was investigated was reflected in the reality of recent times. This ensures that the conclusions are relevant for the usage of the data in the future. Additionally, both SSC and TSC were measured at different moments in time. SSC was split up into three different subscales. This enables the researchers to look at ego depletion and other aspects of self-control separately. Moreover, the duration of this study was two weeks, which is a common timeframe in ESM studies that yields a good response rate (van Berkel, 2018) following recommendations from similar studies (Stone et al. 1991). In the original research, additional information was requested from the respondents. This was done for the initial purpose of the data, the bachelor thesis. This revolved around the following subjects; fatigue, pro-social behavior, anxiety, and perfectionism, which were added to the two questionnaires revolving around self-control. The respondents had to fill in subscales of each topic. Because of the nature of the research questions of this study, this data will be disregarded.

2.5 Data analysis

The data from the daily/weekly surveys and the sociodemographic data were extracted from Ethica and combined into a dataset. This dataset included the answers to the two questionnaires to measure TSC and SSC. The data was then exported to version 26 of SPSS (Statistical Package for Social Sciences). Two variables were created to denote measurement moment (1-45) and to differentiate between weekdays and weekend days (0-1). After this, the data analyses were performed.
The first step that was taken is to describe the sociodemographic statistics of the respondents, this included: age, gender, and nationality. Furthermore, the SSC (daily surveys) and TSC (weekly surveys) were analyzed by looking at the distribution, mean score, and standard deviation of the data. To examine the SSC of the respondents over time, the scores were put into a table that offers the reader a clear overview of the differences in scores over time (working days versus weekend days). To analyze the individual scores a graph was generated. On the x-axis, the measurement point was placed which stated whether it concerned a working/weekend day. The variables SSC and TSC were compared on the y-axis. Only respondents who had a notable mean score, which called for further analysis with visual support were analyzed to see if a pattern could be discovered.

A suitable statistical analysis for data with a longitudinal nature is linear mixed modeling (LMM). It can appropriately deal with data measured repeatedly, meaning multiple entries from one respondent. It can also be applied to disaggregate between-person and within-person level associations. While working with repeated state measurements, per data point and per individual, a first-order autoregressive (AR1) structure was employed. Because ESM studies often have a high occurrence of missing data due to the high amount of entries necessary, this must be dealt with accurately. LMM analysis can accommodate this, without disregarding any of the gathered data (West, 2009).

The first LMM was to examine the association between the TSC and SSC. Both TSC and weekend/weekday were set as a fixed effect. The dependent variable was SSC. A second LMM was utilized to assess the between- and the within-person association between inhibitory self-control as a fixed effect and ego depletion as a dependent variable. Lastly, an LMM was designed to assess the between- and within-person relationship of SSC, with SSC, set as a fixed effect. Ego depletion was subtracted from the construct SSC and set as a separate construct and the dependent variable.

Results

3.1 Descriptive statistics

The 37 respondents in this research were aged between 18 and 26 years old, with a mean age of 21.95 (SD_{age} 1.65). Within this group, 24 respondents are women and 13 are men. 86.5% of the respondents are German, 8.1% of them are Dutch and 5.4% answered that they have a different nationality. 36 of the 37 respondents were students during the course of the research.

Table 3 provides an overview of the means (M), minimum and maximum scores, and the standard deviation (SD) of the respondents on self-control on both *state* and *trait* measurements. The majority of respondents demonstrated a higher score on SSC than their scores on TSC. The correlation analysis showed that TSC and SSC are significant and moderately correlated (r=.33, p<.001). Meaning that respondents who have a high score on TSC tend to have a high score on SSC as well. The daily amount of exerted self-control ranges from .43 to 4.43. A slight difference can be observed between the weekdays and the weekend. Participants generally scored a little higher on self-control during the weekends.

Table 3

Differences between Trait and SSC throughout the week

Variables	Weekdays	Weekend	Total
	Mean (SD)	Mean (SD)	Mean (SD)
TSC	-	-	1.84 (.72)
SSC	2.84 (.83)	2.92 (0.79)	2.86 (.82)
Ego depletion	2.66 (1.00)	2.81 (.97)	2.70 (.99)
Inhibition	2.15 (1.07)	2.19 (1.04)	2.16 (1.06)
Goal-directedness	2.27 (1.05)	2.33 (1.00)	2.29 (1.04)

3.2 Individual analyses

To further examine the fluctuations of SSC over time in people with different levels of TSC, the respondent with the highest score on TSC was selected (37671) and compared to the respondent with the lowest score (38884). The first respondent (37671) that is being examined had the highest score on TSC (M= 3.99). An illustration of the fluctuations between SSC during the week, compared to the mean of TSC can be regarded in Figure 5. Overall, SSC varies throughout the week yet there is no clear pattern that can be discovered when it is compared to either a workday or the weekend.

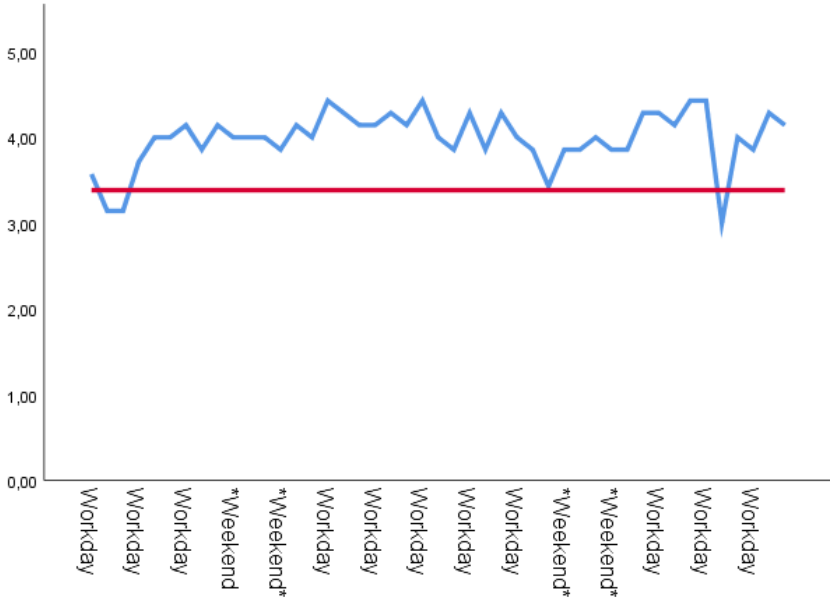

Figure 5 *Mean SSC (blue) and mean TSC (red). Per measurement respondent with a high score on TSC (#37671).*

The second respondent has the lowest score on TSC (M= 2.07). A display of the variation in their SSC throughout the week, compared to their TSC can be found in Figure 6. Note the interruptions within the graphic, the respondent did not answer the surveys in those moments, compared to the respondent with high TSC who filled out every entry. Although the interruptions within the chart make it more challenging to be certain, this graph does suggest a pattern. It appears that this respondent experiences a higher *state* of self-control during the weekends.

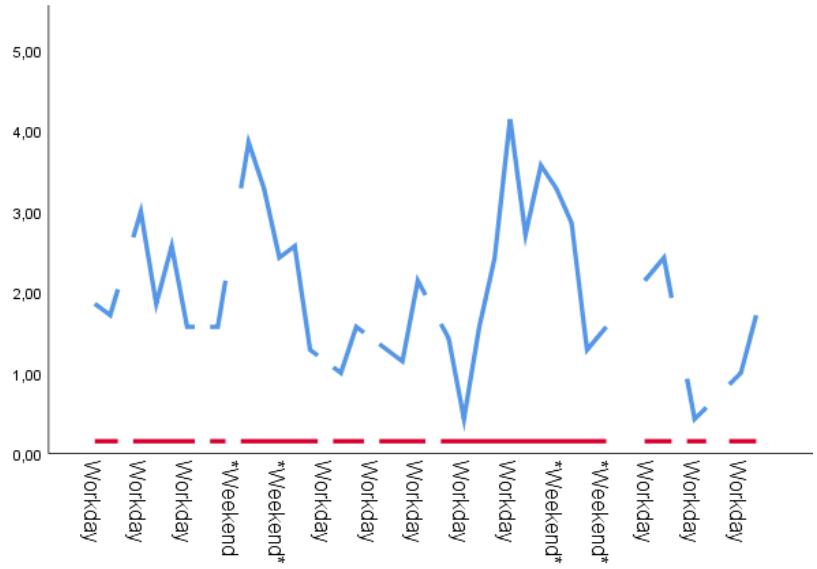

Figure 6 *Mean SSC (blue) and mean TSC (red). Per measurement respondent with a low score on TSC (#38884).*

The second pair of respondents that will be closer analyzed are the two respondents that have the greatest difference between their level of SSC on either *workday (higher) / weekend (lower)* for respondent 30558 or *workdays (lower) / weekend (higher)* for respondent 33527.

Respondent 30558 had the biggest difference between workday (higher) and weekend (lower) SSC. They had a moderately high level of SSC throughout the week (M= 2.85). The difference can be seen in the dip on the first weekend day (Saturday), however, upon closer examination, it seems that this dip is the first sign of a generally lower level of SSC. It is not clear if this is due to the weekend or other external factors.

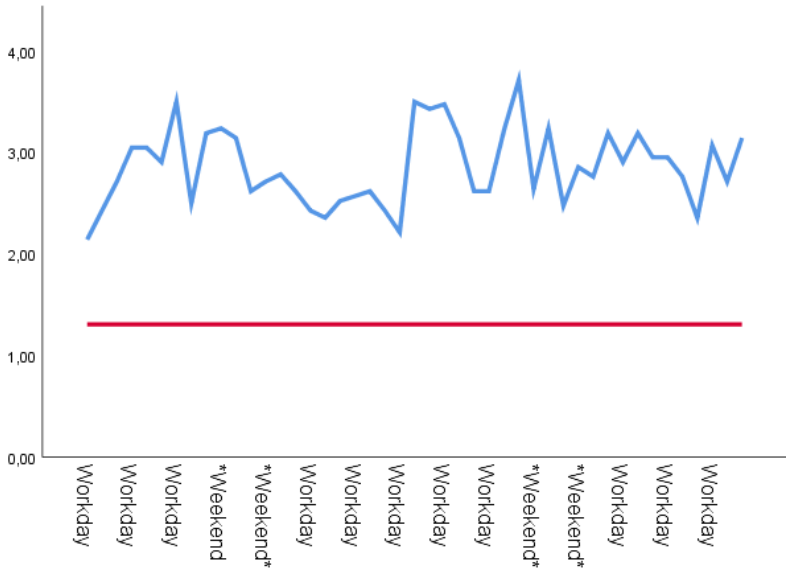

Figure 7. *Mean SSC (blue) and mean TSC (red). Per measurement respondent with a low score on TSC (#30558).*

In the second example of differences between workday and weekend SSC, respondent 33527 showed the largest difference between their workdays (lower) and their weekend (higher) on SSC. The respondent displayed a moderately high level of SSC (M= 2.43). The difference in SSC can be seen in the peaks at the start of the weekend, compared to the mostly lower scores during the workweek.

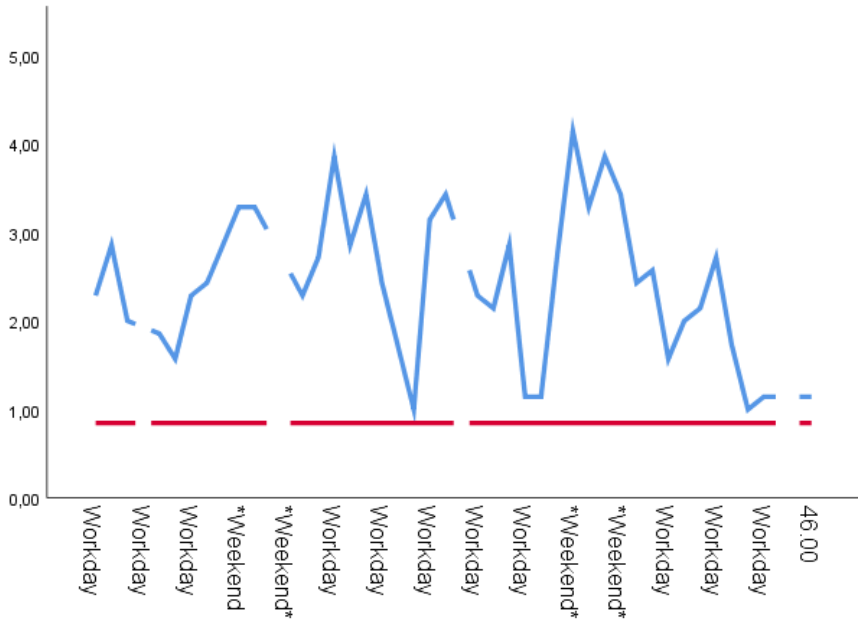

Figure 8. *Mean SSC (blue) and mean TSC (red). Per measurement respondent with a low score on TSC (#33527). Interruptions within the line are missing entries of the surveys.*

The individual analysis does not show a pattern. Two out of the four respondents show an ambiguous pattern of increase in SSC on weekends, but this does not provide convincing evidence since the difference is small. More importantly, for these respondents, there is no clear division between workdays and weekends in terms of self-control. Nor is there any type of pattern for the other two respondents. It seems therefore, no absolute conclusions can be drawn from these visual analyses.

3.3 Linear mixed models

Association between TSC and SSC

An LLM analysis was performed to investigate a possible association between TSC and SSC. In this analysis, TSC was the independent variable and SSC was the dependent variable. The overall association appears to be a moderately positive association (B= .40, p<.001, 95% CI [.30, .50]). The CIs are not wide, which highlights the certainty of this association. This means that every point scored higher on TSC equals an increase of .40 on SSC. This implies that high levels of self-control also flow through into daily life (state).

Additionally, the interaction between the day of the week and TSC on SSC are examined. This showed no significant effect (B= .02, p.84, 95% CI [-.14, .18]), indicating that the combination of both people's level of TSC and the day of the week does not affect SSC. Lastly, the possible effect of the weekend, as was hypothesized, was not found (B= .06, p.73, 95% CI [-.26, .37]). This means that SSC is not influenced by the day of the week.

Between and within-person association of ego depletion and inhibitory self-control throughout the week

The next LMM focused on inhibition as a predictor of ego depletion within respondents. It demonstrated a notably weak yet significant association, with small CI's that underline the certainty of this association (B= .19, p<.001, 95% CI [.14, .24]). This means that when an individual implements self-control by inhibiting a desire, the levels of ego depletion go up.

Between and within-person association of SSC and ego depletion throughout the week

Lastly, an LLM analysis was conducted to further explore the association of SSC as a combination of both goal-directedness and inhibition with ego depletion. The dependent variable was *ego depletion*, the analysis showed a significant positive association between SSC and *ego depletion* (B= .32, p<.001, 95% CI [.26, .37]). This means when SSC increases *ego depletion* goes up with .32. The CI's are also quite narrow, meaning we can say with good certainty that this is a (moderately) weak association meaning that when both *goal-directed* activities and/or *inhibiting* are high, the level of *ego depletion* is also high.

Discussion

Even though self-control is a concept with high relevance to society, an inconsistent body of literature restricts the overall understanding of the concept of self-control and how it operates (Wolff & Martarelli, 2020). The objective of this research was to analyze the relation between self-control as a state and as a trait and track its development throughout the week. Because of the lack of studies painting an accurate picture of self-control outside a controlled environment, this study was designed to fill this lacuna by setting the experiment up in an uncontrolled environment with a longitudinal nature. Another aim that was assessed, was to determine if the day of the week influenced self-control. Lastly, the extent of experienced ego depletion and the role of inhibitory self-control was studied during the two weeks respondents were followed.

Firstly, the relationship between TSC and SSC was explored. A positive relation was found between the two, which indicates that an individual high in TSC typically also displays high levels of SSC. Next, the levels of SSC were further examined during the week and it was found that there is no effect of the weekend influencing SSC the following workweek whatsoever. To shed more light on the level depletion of respondents and the role of inhibitory self-control, ego depletion was subtracted and examined separately from inhibitory self-control. These findings showed that when a respondent inhibits the impulse to act on the desired behavior, their levels of ego depletion are higher. This indicates that ego depletion can be observed outside a controlled environment, albeit being a very weak effect. When both inhibitory self-control and engaging in goal-directed behavior were included as predictors of ego depletion the effect was slightly stronger, which points out that inhibitory self-control and/or engaging in goal-directed behavior are also associated with higher levels of ego depletion. It is not clear yet how long these effects persist.

4.1 Interpretation and similarities in the existing literature

The association that was found between TSC and SSC is in line with the work of Baumeister et al. (2018). Nevertheless, the association that was found in this study was only moderately strong. This implies that other factors influence self-control independently. It seems that this concerns different factors. Because of the different nature of both constructs, SSC is likely more reactive due to the high possibility of fluctuations. These factors may respond to external influences such as sleep (Hisler et al., 2018). Increased levels of stress-mediated by a period of short sleep show a greater difficulty for self-control that following day (Hisler et al., 2018). Another example of external factors is negative affect. When an individual finds themselves in a negative mood, they tend to prioritize mood repair over further self-control goals (Simons et al. 2016). A physiological explanation that can specifically influence ego depletion is low blood glucose associated with a lack of willpower (Gailliot et al., 2007). They showed that after implementing self-monitoring, glucose levels in the blood drop. These low levels of glucose predict poor performance on a self-control task.

Important to note is that in the previous work of Baumeister (2018) he defined SSC only as ego depletion. Within this study, a broader view was employed, combining ego depletion with goal-directed behavior and inhibitory self-control. The association between SSC with TSC indicates that SSC is bigger than merely ego depletion, due to the two added concepts. It also indicates that next to ego depletion, these two components also fluctuate in time and are influenced by the context of daily life. When further investigating self-control there should be a differentiation made between SSC and TSC and how they are influenced by both internal and/or external factors.

The found relationship in this research between TSC and SSC does not differ on either working days or the weekend. In addition, the weekend or the workweek do not significantly influence SSC. Whilst examining the visual analyses, there seemed to be a slight pattern at first glance, mainly for the last two respondents. However, this was not supported by the LMM analysis. Therefore, it can be said that this slight pattern is based upon chance and does not reflect the majority of the respondents. This means that SSC is not likely to have a set pattern or have a peak or a dip at some point dependent on the day of the week. The effect of the weekend that was seen on wellbeing (Jeong et al., 2020) and psychological stressors (Ragsdale et al., 2011) due to relaxing weekend activities was not observed regarding SSC within this study. Important to note however is that although the levels of SSC were reported by respondents, why those levels peaked or dropped was not described by them. This means that there is no specific information on whether people were busy during the weekends with either relaxing or non-relaxing activities and what the reasons were why they displayed low or high levels of SSC. However, with this nuance in mind, the results of this research do not indicate that there is any effect of the weekend or workweek on SSC.

In accordance with current literature on ego depletion, the results of this study show that when someone inhibits their impulses, they experience a sense of depletion which is similar to the findings by Baumeister et al. (2018). However, when the construct inhibitory self-control was compared to ego depletion, the data showed that inhibition plays a modest role rather than the prominent role which it is linked to in existing literature by Baumeister et al., (1998); Baumeister et al., (2006); Hagger et al., (2010). The findings of this research have a stronger tendency to the findings of Francis and colleagues (2018) who found an effect that points to the existence of ego depletion, yet it only concerns small effects. This means that ego depletion can be observed in an uncontrolled setting but it seems that it might not play as big of a part as initially thought.

This study showed that TSC is correlated with an individual's ability to apply SSC in daily life. As self-control is related to various benefits, it may be of interest to train self-control. According to Chongmin & Paternoster (2012), there is a possibility for growth in self-control, even in those with a history of low levels of self-control. However, Miles et al., (2016) did not find an effect of training self-control. There was no reduction found in feelings of (ego) depletion, respondents did not get better at overcoming habits nor did they report more self-control in their lives after completion of the training Miles et al., (2016). In addition to this, after analyzing multiple comparable studies of training

self-control in the meta-analysis by Friese et al., (2017), a small-to-medium effect was found. Interestingly, when bias-correction techniques were applied the effect sizes shrunk even further. The presence of small-study effects but also publication bias serves as an explanation for this (Friese et al., 2017). To find ways to enhance self-control, it may be interesting to take a different approach and examine what different aspects can be specified to let the self-control of an individual thrive. Duckworth & Seligman (2017), appoint certain training to effectively exercise self-control, which is focused on the specific qualities that are needed. Examples of training courses that are possibly useful are teaching goal-setting and planning strategies (Duckworth & Seligman, 2017), situational strategies for self-control (Duckworth et al. 2016), and cognitive strategies to help with overpowering (negative) emotions (Mischel et al. 2011). When aiming to enhance self-control, it may be more logical to focus on building a certain set of subqualities like these mentioned in the different training settings. To eventually gain momentum on the 'bigger' construct of self-control. This is in line with findings in this research, that self-control is influenced by many factors, making it plausible it can be enhanced by targeting different qualities. Therefore, everything is not lost when one does not possess a strong baseline of TSC (yet), there are multiple ways to help somebody enhance it.

4.2 Strengths, Limitations, and Future Implications

An important strength of this research is the ESM design, it protects the ecological validity of a study by preserving the stimulus in a natural setting (van Berkel, 2018), whereas existing literature on self-control is mostly based on experiments in controlled environments and is also considerably shorter than a typical ESM design, which puts a strain on the generalizability of such studies.

As with all research, there are limitations to this study. A prominent limitation is that, as mentioned before, respondents were not able to report the activities they engaged in during the day. When a lower/higher level of SSC was reported, there was no information as to why respondents experienced that. Were respondents tired of the previous workweek or did they simply find themselves in a bad mood. This lack of information to provide more context limited the ability of this study to fully answer predefined questions. Another limitation is that the respondents were almost exclusively students. This is not a representable sample of society, which may have caused a bias when interpreting the results. Students are likely to have a level of self-control that is quite high, due to the level of education they have acquired (Oriol et al., 2017). People who have more difficulties with self-control might only be partially represented within this sample or not at all.

Next to these limitations, multiple suggestions can be made for future research. Because of the high levels of fluctuations in SSC, continuing with an ESM design would be recommended. This method allows to grasp and report the capricious nature of self-control since broad constructs like self-control can be difficult to assess via cross-sectional questionnaires (Verhagen et al., 2016). Also, due to the found associations between SSC and TSC, it would be important to include both constructs, since they are interconnected. There lies an opportunity for future scholars to deepen their knowledge

about self-control, what factors influence SSC in a natural setting, and how. This could be examined by, for example, including the activities respondents engaged in during the study. To have more of a context that may help determine what causes fluctuations in the SSC of respondents.

This study was conducted during a global pandemic including restrictions that had profound implications for respondents' daily lives and therefore might have had an influence on the levels of self-control of respondents. For example, Vindegaard & Benros (2020), found that the pandemic has decreased the overall well-being of the general public. Hence, it is advised to organize an upcoming study when daily life has resumed, or when the measures do not have far-reaching consequences. This has a high probability of influencing the behavior of respondents and perhaps skewing the results.

The last implication is to work with a more diverse group of respondents. It would be more appropriate to work with a diverse sample because this both increases the robustness of the findings and the ability to generalize the findings of the study (Blair, 2006). Only having fairly young respondents and the majority having the same occupation (student) might not yield results that are representable and relevant for the rest of society. Therefore, in future research, a sample with more variety in profession and age would be deemed more appropriate.

4.3 Conclusion

To conclude, this research is one of the first studies to examine trait self-control (TSC) and state self-control (SSC) independently, in a lengthy timeframe and assessing the influence of the day of the week. A moderately strong association was found between the two constructs trait self-control and state self-control. This association was not affected by the day of the week, nor did the day of the week have a direct effect on state self-control. It was additionally shown that when someone participates in goal-directed behavior and/or inhibits their impulses, the levels of ego depletion they report are also high. However, this study did not control for the activities respondents engaged in, which is suggested as an implication for future studies. Another implication would be to use a more diverse sample and redo the study when the limitations of the pandemic are through.

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Appendix A

Trait Questionnaire

13-item Brief Self-Control Scale (Tangney, Baumeister, & Boone, 2004).

1. I am good at resisting temptation

*2. I have a hard time breaking bad habits**

*3. I am lazy**

*4. I say inappropriate things**

*5. I do certain things that are bad for me, if they are fun**

6. I refuse things that are bad for me

*7. I wish I had more self-discipline**

8. People would say that I have iron self- discipline

*9. Pleasure and fun sometimes keep me from getting work done**

*10. I have trouble concentrating**

11. I am able to work effectively toward long-term goals

*12. Sometimes I can't stop myself from doing something, even if I know it is wrong**

*13. I often act without thinking through all the alternatives**

Note *item reverse coded

Appendix B

Ethica

Informed Consent

This study aims at identifying determinants that correlate with self-control. Therefore, multiple constructs will be tested simultaneously, namely fatigue, perfectionism, pro-social behaviour and anxiety. At the beginning of participation, after one week, and at the end, you will be asked to fill in a questionnaire that takes approximately 20 minutes. In between, you are asked to answer a short questionnaire three times a day, over a time span of 15 days.

Your participation in this study is completely voluntary and you can withdraw from it at any time without reason. All data will be treated anonymously and will not be shared with third parties.

If you have any further questions or would like to receive more information about the study, please feel free to contract the researchers;

If you have ethical complains about the study, please contact the Ethics Committee of the Faculty of Behavioural Sciences at the University of Twente:

Email: ethicscommittee-bms@utwente.nl

I understand the statements above and agree to participate in this study

() I agree that I have been informed properly and that I had the opportunity to ask questions, if wanted.

() I agree that I am participating on a voluntary basis and that I can quit my participation without reason, if wanted.

() I agree that my data will be used anonymously for research and that it can be removed, if Wanted