Training discipline in three minutes?

Carina Hausladen[*]

August 20, 2015, Passau

Abstract

Every student knows how exhausting exam periods are. Getting up early every day for weeks calls for a lot of discipline. Luckily there is a remedy: Evidence indicates that regular exercise produces broad improvements in self-regulation, almost like strengthening a muscle. However participants had to train at least for two weeks during such studies. The following paper investigates the question how long it takes the discipline-muscle to grow. During a laboratory experiment self-regulation was trained by using the non-preferred hand to move a computer mouse. However, a difference in difference analysis reveals that the treatment group did not show any significant improvement in self-regulation after the training.

[*]Graduate student in International Economics and Business, University of Passau, e-mail: carina.hausladen@gmx.de

Contents

List of Figures

List of Tables

1 Motivation and introduction

Every student knows how exhausting exam periods are. Getting up early every day for weeks and all one can look forward to is lunch break. Endless hours of studying in the library requires a lot of discipline. I found out that getting up really early at 5 am and running for an hour gives me so much drive to survive the whole day in the library. In order to find out why this strategy works so well, I conducted some research. There is evidence indicating that regular exercise produces broad improvements in self-regulation almost like strengthening a muscle. However, participants had to train at least for two weeks during such studies. On the contrary, I have the feeling that getting up early on one day induces discipline, while sleeping in and eating chocolate on the other day crashes motivation completely for the current day. Therefore, I conducted a laboratory experiment which tested whether discipline could be trained in just three minutes via a slider task. However a differences-in-difference analysis reveals that the treatment group did not show any significant improvement in self-regulation after the training.

2 Literature

Current evidence suggests that self-regulation relies on a limited resource, comparable to energy or strength (Muraven and Baumeister, 2000). When this limited resource has been used, the person falls into a state of ego depletion, during which further efforts of self-regulation are less successful (Baumeister et al., 2006, p.1774). This description resembles a muscle that becomes tired after exertion. The pattern of ego depletion has been replicated in various studies: When people have exerted some of their self-regulatory strength on an initial task, they are less successful at subsequent tasks like reasoning and thinking problems (Schmeichel et al., 2003, p.3). Furthermore, dieters are more likely to break their regime when depleted (Vohs and Heatherton, 2000).

However, there is a second aspect to the muscle analogy: In the short run, exercise weakens a muscle but in the long run, exercise strengthens it. There is evidence that individuals can increase their power: Training induces their strength to be less quickly depleted by current demands (Baumeister et al., 2006, p. 1774). Initial evidence for increasing self-regulatory strength was provided by Muraven et al. (1999). Participants attended a laboratory session in which they first completed a baseline measure of hand-grip stamina, then participated in a thought suppression task of not thinking about a white bear and then performed the hand-grip task again. The treatment group subsequently engaged in one of three self-regulatory exercises for two weeks, after which they returned to the laboratory and performed the thought suppression and hand-grip tasks again[1]. The treatment group showed an overall improvement in self-regulation. Oaten and Cheng (2006) and Oaten and Cheng (2007) conducted similar structured studies with two different types of self-regulation exercises. Their laboratory sessions were the same in each study: Baseline self-regulation was assessed in the laboratory with a visual tracking task (VTT)[2]. The participants were administered a five minute depletion task after which they performed the VTT again. As the thought suppression exercise depleted self-control resources, participants performed worse on the second VTT than on the first. After the first laboratory session, the treatment groups were either enrolled in physical exercise programs for two months (Oaten and Cheng, 2006) or signed up for a four month program in financial monitoring (Oaten and Cheng, 2007), then they went through the laboratory session again. As a result of the training regime, the depleting effect was substantially diminished in both studies: VTT performance was less adversely affected by the thought suppression exercise. Adherence to a program was also beneficial to self-control in other spheres, e.g. reducing

---

[1]The training involved tracking food eaten, improving mood, or improving posture.
[2]The VTT required people to keep their attention on visual targets despite a humorous distractor (Oaten and Cheng, 2006, p.721).

smoking or studying more and watching less television (Oaten and Cheng, 2006, p.726), (Oaten and Cheng, 2007, p.499).

3   Theory and hypothesis

Self-control occurs when a person attempts to change the way he or she would otherwise think, feel or behave (Muraven and Baumeister, 2000, p.247). As self-control strength is limited, it behaves like a resource that can be depleted (Muraven and Baumeister, 2000, p.248). Tasks that do not require self-control do not deplete the self-control amount available. There is some evidence that individuals can increase their power via training, at least to the extent that their strength is slower depleted in responding to current demands (Baumeister et al., 2006, p.1774). Most training sessions of these studies lasted between two weeks to four months. There was no study I could find which induced a shorter training period. Therefore, the question of how long the self-control muscle needs to grow, is not addressed. From my own experience, as mentioned in the introduction, I hypothesize that self-discipline training can have an immediate effect. The exact hypothesis is developed in the following part and will be stated at the end of it.

3.1   Between subjects design

To investigate whether self-regulation can be trained in a short period, a laboratory experiment was conducted. The structure of the latter mainly resembles the structure of the studies mentioned in the literature part.

Table 1: Muraven et al. (1999)

All participants	
Lab session 1	Hand-grip, Thought suppression, Hand-grip
Training	e.g. Tracking food eaten
Lab session 2	Hand-grip, Thought suppression, Hand-grip

Table 1 acts as an example and shows that the study by Muraven et al. (1999) is structured as within subjects design. This approach is not only time consuming but it requires a participant coming to the laboratory twice. This could not be properly ensured for the experiment at hand as only sweets instead of money stated the incentive. Therefore this experiment is structured as between subjects design[3].

Table 2: Experiment

Treatment Group	_Control Group_
Training	No Training
Anagrams, Thought suppression, Anagrams	Anagrams, Thought suppression, Anagrams

In order for a between subject design to be meaningful, the participants have to be randomly selected into treatment and control group. This was ensured by seat-numbers which were drawn from a box by

---

[3]see Table 2.

the participants . All odd-numbered seats were registered as control group, all even-numbered seats as treatment group.

3.2 Description of the tasks

As can be seen in Table 1, a typical experiment conducted in the field of self-regulation consists of a training part and a laboratory session. The latter is divided into three tasks. The following section answers the question of why the laboratory session is structured the way it is as well as the nature of the tasks and the training.

Different methods had been used to train self-control. In Muraven et al. (1999) half of the participants were assigned to improve their posture whenever they thought of it, the other half kept track of what they ate. Oaten and Cheng (2006) enrolled participants in physical exercise programs for two months[4]. In Oaten and Cheng (2007) participants signed up for a four month program on financial monitoring. Gailliot et al. (2007) asked their participants to either exercise self-control by modifying their manner of speaking for two weeks[5], or they were asked to use their non-preferred hand for a variety of tasks[6]. In the experiment at hand, the treatment group was asked to use the non-preferred hand for using a computer mouse. During a slider task participants earned a point if they moved the slider to position 50[7]. In order to ensure that participants use the mouse instead of keys, "Windows killkeys" was installed on every computer in the laboratory[8]. The advantage of the slider task as training is, that the position of the slider can be tracked exactly, which provides a measure of the intensity of the training.

The solving of anagrams stated the dependent measure in this study. An anagram is a word formed from another one by rearranging its letters, e.g. *angel* is an anagram of *glean*. Success at solving anagrams has been used frequently in prior research on self-regulation. In Gailliot et al. (2007, p.284) participants had to complete as many anagrams as possible in five minutes. Gordijn et al. (2004, p.217) measured, how many five-letter anagrams participants were able to unscramble in five minutes. In Baumeister et al. (1998, p.1259) participants received anagrams that they were to unscramble during a period of six minutes. The ability to solve anagrams is an appropriate dependent measure because it has no direct relation to the thought suppression or slider task. Success at solving anagrams requires - apart from skills - some degree of self-regulation: One must keep breaking and altering the combinations of letters one has formed and must make oneself keep trying despite failures (Baumeister et al., 1998, p.1258).

As thought suppression task the participants were asked not to think about a white bear for three minutes. This task was also used by Muraven et al. (1999), Oaten and Cheng (2006) as well as Oaten and Cheng (2007). The task was initially developed by Wegner et al. (1987) who instructed participants to say out loud their thoughts as they either thought about a white bear (express condition), or tried not to think about a white bear (suppress condition). Members of the suppress-condition-group had a hard time: Their thoughts often returned to what they were trying to suppress. In contrast,

---

[4]The hypothesis was that adhering to an exercise program requires self-regulation. Therefore two months of regular effort would improve the capacity for self-regulation in general.

[5]Specifically they were asked to only say "yes" and "no" instead of using similar colloquialisms, to speak only in full and complete sentences, to avoid using sentences that began with "I", and to not use slang or swear words (Gailliot et al., 2007, p.284).

[6]Such tasks could include brushing their teeth, opening doors, eating with utensils or using a computer mouse (Gailliot et al., 2007, p.287).

[7]see Figure C.1.

[8]The programm blocks the arrow keys.

participants in the express condition were successful at thinking more about the white bear. This suggests that thought suppression is difficult, whereas thought expression is much easier (Wegner et al., 1987, p.11).

Combining the anagram and the white bear task, the prediction states as the following: Participants who had already tried to control their thoughts would suffer from ego depletion and, as a result, perform more poorly at solving anagrams than before the thought suppression task (Baumeister et al., 1998, p.1258). As the slider task acts as a training for self-regulation, the hypothesis states the following: Those participants who have trained their self-regulation capacity during the slider task will experience less ego depletion induced by the white bear task and therefore perform better in the second anagram task than the control group.

4   Analysis

The experiment was a laboratory session, programmed with z-Tree, which took place at the computer laboratory in the economics department at Passau University. Overall, nine sessions were conducted on june 16th, 2015 and on june 19th, 2015. The participants were recruited by addressing them in the corridor as well as by posters distributed in the university. As incentive they got sweets and cake after their participation. The laboratory included 21 seats which were separated by barriers. Before the experiment has started, general instructions were read out by the experimenter[9]. After this short introduction, the computer session started. The slider, anagram and white bear task each took three minutes. Participants had as much time as they wished to complete the surveys[10].

4.1   Survey

The analysis of the demographic survey shows that amongst 138 participants 52 were male and 86 female. The mean age is about 22,2[11]. The major of the participants is not evenly distributed, as the computer laboratory, in which the experiment took place, was located in the economy and business department of the university. Therefore more than 50 participants are involved in business or economics studies, more than 30 participants in cultural studies or European studies[12].

The hypothesis states that the treatment group should be able to solve more anagrams in the second anagram task than the control group. The key identifying idea of this approach is that treatment and control group are the same. As the participants were randomly selected into the two groups, this should have worked. In order to investigate this issue, the participants filled in the "General Self-Efficiacy-Scale" by Schwarzer and Jerusalem (1999). Each question was assessed on a five-point scale, with higher scores indicating higher perceived self-efficacy. The scale was used by Oaten and Cheng (2006) as well as Oaten and Cheng (2007)[13]. To evaluate the questionnaire, the numbers of the answer possibilities were summed up separately for the treatment and control group. As Table 5 shows no difference in means, it can be concluded that randomization worked.

4.2   Slider

In the training section of the experiment the participants were asked to move sliders to position 50[14]. The treatment group was asked to move the mouse with their non-preferred hand. This means that

---

[9]see Appendix A.
[10]Detailed instructions of all tasks can be found in Appendix A.
[11]The distribution of the age is shown by Figure B.1.
[12]see Figure B.2.
[13]The questions in an English and German version can be found in Appendix C.
[14]Figure C.1 shows a screen-shot of the slider task.

right-handed should use their left hand. For left-handed the instruction said that if they usually use the mouse with their right hand, they shall use their left hand. The control group was not given any instructions on which hand to use. As the training should cause the treatment effect, it is important to analyse whether members of the treatment group accomplished the task correctly. If a lot of members of the treatment group used their preferred hand to move the slider, e.g. because it is exhausting to use the non-preferred hand, the mean of correctly placed sliders would be the same in treatment and control group. As Table 6 shows that the control group significantly placed eight sliders more, the former reflection is disconfirmed. The distribution of correctly placed sliders shows that 25 individuals did not place one slider correctly[15]. As 14 of them are part of the control group and eleven are part of the treatment group, they are evenly distributed between the groups and therefore do not cause a distortion. A closer look at the exact position of the slider reveals that twelve of 25 did not read the instructions carefully as they moved the slider to position 100 instead of position 50. One person always moved the slider to position 42[16]. The remaining 12 participants did not reveal any deterministic pattern.

4.3 Anagrams

The anagram task showed up twice during the experiment: The first time it showed up, it acted as a baseline measure, the second time should reveal a depleted ego, induced by the thought suppression task. A closer look at the z-Tree output reveals mistakes in counting the number of correctly solved anagrams. The corrected list in Appendix D hints at participants not having read the instructions carefully[17]. Even if they were exhorted not to use capital letters, some did so. Nevertheless correctly solved anagrams with capital letters were accepted as correct. Some participants constructed rhymes instead of anagrams or did not use all or too many letters. The last mistake caused some problems. The text field of z-Tree was programmed to not accept an input of more than ten letters. No anagram had more than six letters. However three participants typed in more than ten letters, as a result, they got a pay-off of zero.

4.3.1 Descriptive analysis

The number of solved anagrams measures the effectiveness of the treatment. Table 3 shows the mean performance of the treatment and control group during the anagram task. "Anagram 1" indicates the first time the participant solved anagrams, "Anagram 2" indicates the second time[18]. Overall adds "Anagram 1" and "Anagram 2". "Diff_tc" calculates the difference between treatment and control group, "Diff_A2A1" the difference between "Anagram 2" and "Anagram 1". The values for the latter are 4.221 for the treatment group and 3.171 for the control group. These values differ by 1.049 anagrams which might be an indicator of the treatment effect.

---

[15]see Figure C.2.

[16]It seems that this participant is a fan of "The Hitchhiker's Guide to the Galaxy" by Douglas Adams. In the novel, the protagonist demands to learn the answer to the ultimate question of life, the universe, and everything from a supercomputer. It takes the computer $7\frac{1}{2}$ million years to compute the answer, which turns out to be 42.

[17]The correct answers for which the participants received a point are put in quotation marks. The numbers below indicate the frequency of how often this solution was proposed.

[18]The second time occured after the white bear task was completed.

Table 3: Means anagram task

	Control	Treatment	Overall	Diff_tc
Anagram 1	7.129	6.603	6.870	−0.526
Anagram 2	10.300	10.824	10.558	0.524
Overall	17.429	17.426	17.428	1.049
Diff_R2R1	3.171	4.221	3.688	1.049

4.3.2 Differences-in-differences approach

A differences-in-differences regression should verify whether the treatment group significantly solved 1.049 anagrams more than the control group. In order for such an approach to be informative, the no-selection-into-treatment-assumption must be met. As every participant randomly drew a seat number, which determined treatment and control group, no participant could select oneself into treatment. The regression model looks like the following:

$$Y_i = \alpha + \beta D_i + \gamma A + \delta(D_i * A) + \epsilon_i \tag{1}$$

$D_i = 1$ indicates the treatment status , whereas $D_i = 0$ indicates being in the control group. The subscript i stands for multiple individuals. $A = 0$ indicates "Anagram 1", $A = 1$ indicates "Anagram 2". The coefficient δ in front of the interaction term $D_i * A$ is supposed to indicate the treatment effect. Running the regression generates the following output:

Table 4: Regression Results

	Dependent variable:
	Correctly solved anagrams
dummy_ana	3.171***
	(0.722)
dummy_tc	−0.526
	(0.727)
interaction	1.049
	(1.029)
constant	7.129***
	(0.511)
Observations	276
R^2	0.162
Adjusted R^2	0.152
Residual Std. Error	4.272 (df = 272)
F Statistic	17.489*** (df = 3; 272)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 4 shows that the coefficient of dummy_ana which is equal to "Diff_R2R1" is significant, as well as the constant, which is equal to "Anagram 1", the baseline ability of the control group to solve anagrams. As the coefficient of the interaction term is not significant, it can be concluded that the

training had no impact on the treatment group's capacity of self-regulation[19]. It is already mentioned in chapter 4.2 that some participants showed zero effort in the slider task. As there is a slightly positive correlation between slider and anagram performance[20], participants with zero effort were excluded from the subsequent regression. So were participants with zero correctly solved anagrams as this was due to an error in programming. Table 8 shows that the differences-in-differences estimator is slightly smaller but still insignificant.

4.4   White bear

The thought suppression task, during which the participants were asked not to think about a white bear, should induce ego depletion. However, if a participant allows himself to think about the white bear, his ego will not be depleted as much as the ego of someone trying to suppress the thought. In order to investigate this issue, all letters one participant wrote during the task were counted. The means of typed letters allow to compare treatment and control group. Table 9 shows that the latter are identical in both groups. Therefore, it can be presumed that ego depletion occurred to the same extent in both groups. When having a closer look at the text produced during the thought suppression task, different strategies emerged. A lot of the participants thought about what to eat or about their upcoming classes at university. Others tried to imagine animals having a different colour than white. Others payed closer attention to their environment, as noticing the noise of a passing train, the smell of the room or reading the labels of the computer. Some of them just wrote down single words that came to their minds. There are a few examples attached in Appendix E.

5   Interpretation and conclusion

Current research suggests, self-regulation resembles a muscle which can be trained. Usually such training periods last between two weeks to four months. There is no study examining the exact duration of the training period. Therefore I test the hypothesis, whether discipline can be trained in three minutes. A differences-in-differences analysis reveals that participants who trained self-regulation during a slider task, reacted in the same way to the ego depletion task as the control group: After the ego depletion task they solved about the same amount of anagrams as the control group. The fact that no treatment effect emerged, could be due to several reasons. First, there is evidence that the participants did not exert their full potential. The experiment was incentivized with sweets and cake instead of money. During the thought suppression task a lot of the participants wrote that they do not have any desire to finish the experiment. A few participants earned no points in the slider task. This shows that those did not read the instructions carefully. If they lack the willpower to read instructions why should they exert their full potential during the task itself? A second reason causing insignificance might be that the training itself has not been intense enough. Moving sliders with the non-preferred hand might be exhausting but doing so just for three minutes might not train self-regulation enough to produce a significant effect in the anagram task. Therefore, it would be interesting for future research to chose a short but more intense training program. All in all, it is still to be asked how long it takes to train one's willpower.

---

[19] The coefficient of the interaction term as well states the differences-in-differences estimator.

[20] see Table 7.

A Instructions

General Instructions

Herzlich Willkommen! Vielen Dank für Ihre Bereitschaft, an zwei kurzen Experimenten teilzunehmen. Bevor das erste Experiment startet, einige allgemeine Erläuterungen vorab: Mit den Experimenten wollen wir Erkenntnisse über menschliches Verhalten gewinnen. Die Teilnehmer an den Experimenten befinden sich alle hier im Raum und nehmen an denselben Experimenten teil. Alle Teilnehmer sind anonym und können sich nicht untereinander absprechen. Auch Ihre Entscheidungen und Angaben werden anonym ausgewertet. Bitte verhalten Sie sich während der Experimente ruhig und sprechen Sie nicht mit Ihrem Nachbarn. Beachten Sie, dass es während der Experimente zu Wartezeiten kommen kann. Haben Sie einen Bildschirm einmal verlassen, kann dieser nicht erneut aufgerufen werden. Die erzielten Gewinne können leider nicht ausbezahlt werden. Versuchen Sie dennoch sich vorzustellen und sich so zu verhalten, als würde um echtes Geld gespielt werden. Auf der folgenden Seite wird der Ablauf des ersten Experimentes erklärt. Bitte lesen Sie die Anleitung sorgfältig durch und heben Sie Ihre Hand im Falle noch offener Fragen. Ein Spielleiter kommt dann zu Ihnen. Sie können jetzt mit dem ersten Experiment beginnen: Klicken Sie dazu auf 'Experiment starten'.

Instructions in z-Tree

0. Spielanleitung

Herzlich Willkommen! Hier sehen Sie einen kurzen Überblick des Experimentes:

1. Aufgabe

2. Aufgabe

3. Aufgabe

4. Aufgabe (Gleich aufgebaut wie Aufgabe 1)

5. Fragebogen

Jede Aufgabe wird drei Minuten bearbeitet. Sie können während des Experimentes Taler verdienen. Detaillierte Informationen zu den einzelnen Aufgaben finden Sie auf den Bildschirmen unmittelbar vor den Aufgaben. Bitte klicken Sie auf Ëxperiment starten".

1. Slider Task

1.1 Treatment Gruppe

Sie haben im Folgenden drei Minuten Zeit, um die Slider in die Mitte (Poisition 50) zu bewegen. Verwenden Sie dazu bitte die Hand, mit der Sie normalerweise nicht die Maus bedienen. Wenn Sie Rechtshänder sind, verwenden Sie bitte Ihre linke Hand. Wenn Sie Linkshänder sind, die Maus normalerweise mit rechts bedienen, verwenden Sie bitte Ihre linke Hand. Für jeden korrekt platzierten Slider (Position 50) erhalten Sie einen Taler.

1.2 Kontroll Gruppe

Sie haben im Folgenden drei Minuten Zeit, um die Slider in die Mitte (Position 50) zu bewegen. Für jeden korrekt platzierten Slider (Position 50) erhalten Sie einen Taler.

2. Anagramme

Sie haben im Folgenden drei Minuten Zeit, um so viele Anagramme wie möglich zu lösen. Ein Anagramm ist ein Wort, das durch eine andere Anordnung seiner Buchstaben ein neues Wort ergibt. Es müssen alle Buchstaben verwendet werden. z.B. aus lampe"wird palme". Bitte schreiben Sie nur in Kleinbuchstaben. Bitte verwenden Sie nur deutsche Wörter. Es gelten sowohl Substantive (auch in deklinierter Form), Verben (auch in konjungierter Form), Adjektive (auch in flexierter Form), als auch Pronomen. Pro richtigem Anagramm erhalten Sie 1 Taler.

3. Weißer Bär

Aufgabe 3 dauert drei Minuten. Es ist Ihre Aufgabe, auf keinen Fall an einen weißen Bär zu denken. Versuchen Sie bitte mit aller Anstrengung das Gedankenbild zu unterdrücken. Damit es für Sie leichter ist, die Konzentration zu behalten, notieren Sie bitte all Ihre Gedanken innerhalb des Textfeldes im folgenden Bildschirm. Bestätigen Sie jeden Gedanken mit der ËnterTaste. Ihre Angaben werden anonym ausgewertet.

B   Survey
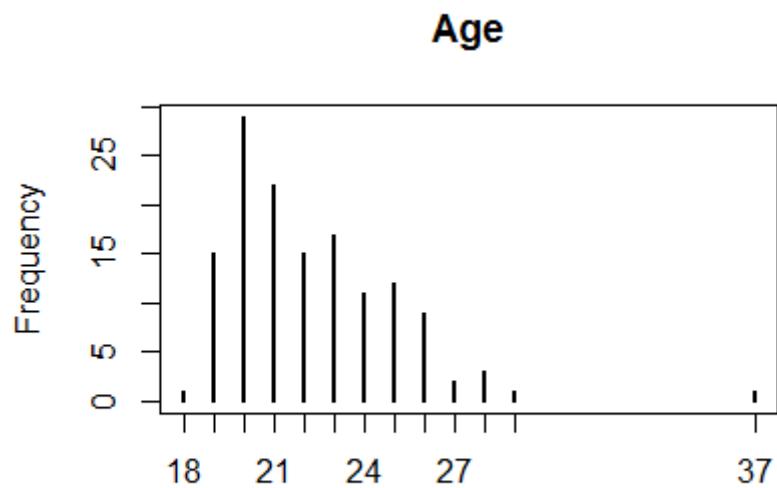

Figure B.1: Age distribution
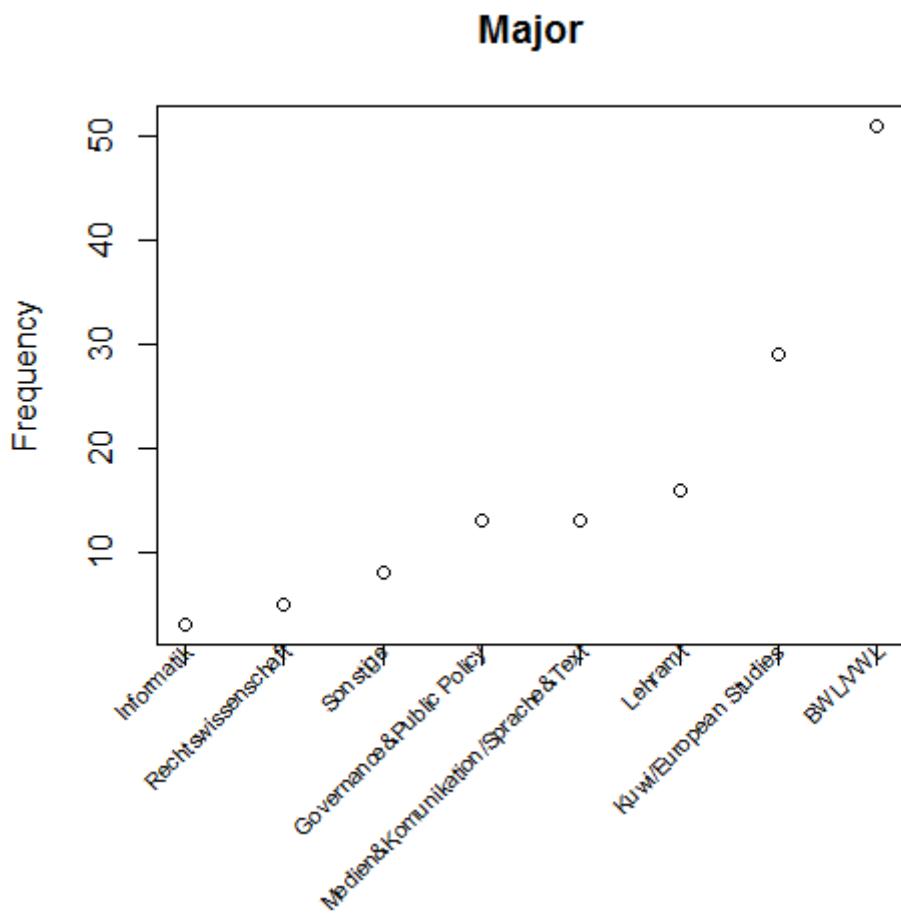
Major

Figure B.2: Major

English version by Schwarzer and Jerusalem (1995)

1. I can always manage to solve difficult problems if I try hard enough.
2. If someone opposes me, I can find the means and ways to get what I want.
3. It is easy for me to stick to my aims and accomplish my goals.
4. I am confident that I could deal efficiently with unexpected events.
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.
6. I can solve most problems if I invest the necessary effort.
7. I can remain calm when facing difficulties because I can rely on my coping abilities.
8. When I am confronted with a problem, I can usually find several solutions.
9. If I am in trouble, I can usually think of a solution.
10. I can usually handle whatever comes my way.

Response Format:

(1) Not at all true (2) Hardly true (3) Moderately true (4) Exactly true

German version by Schwarzer and Jerusalem (1999, p.13)

1. Wenn sich Widerstände auftun, finde ich Mittel und Wege, mich durchzusetzen.
2. Die Lösung schwieriger Probleme gelingt mir immer, wenn ich mich darum bemühe.
3. Es bereitet mir keine Schwierigkeiten, meine Absichten und Ziele zu verwirklichen.
4. In unerwarteten Situationen weiß ich immer, wie ich mich verhalten soll.

5. Auch bei überraschenden Ereignissen glaube ich, daß ich gut mit ihnen zurechtkommen werde.

6. Schwierigkeiten sehe ich gelassen entgegen, weil ich meinen Fähigkeiten immer vertrauen kann.

7. Was auch immer passiert, ich werde schon klarkommen.

8. Für jedes Problem kann ich eine Lösung finden.

9. Wenn eine neue Sache auf mich zukommt, weiß ich, wie ich damit umgehen kann.

10. Wenn ein Problem auf mich zukommt, habe ich meist mehrere Ideen, wie ich es lösen kann.

Antwort Format:

(1) stimmt nicht, (2) stimmt kaum, (3) stimmt eher, (4) stimmt genau.

Schwarzer and Jerusalem (1999, p.13)

Table 5: t-test survey

	t
Test statistic	-0.300282
DF	135.9016
p-value	0.7644209
Mean Treatment Group	2.798571
Mean Control Group	2.822059

Welch Two Sample t-test

C Slider

Table 6: t-test slider

	t
Test statistic	1.191797
DF	135.6268
p-value	0.2354221
Mean treatment group	15.61429
Mean control group	13.26471

Welch Two Sample t-test
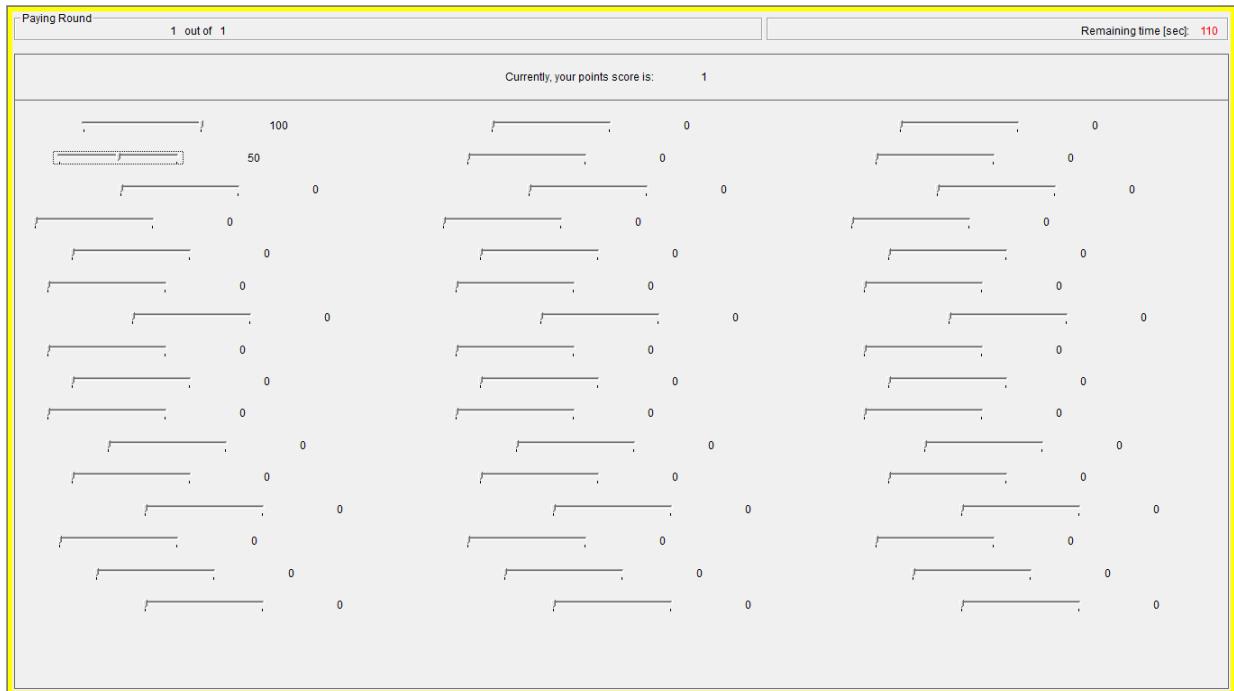
Figure C.1: Screenshot slider task
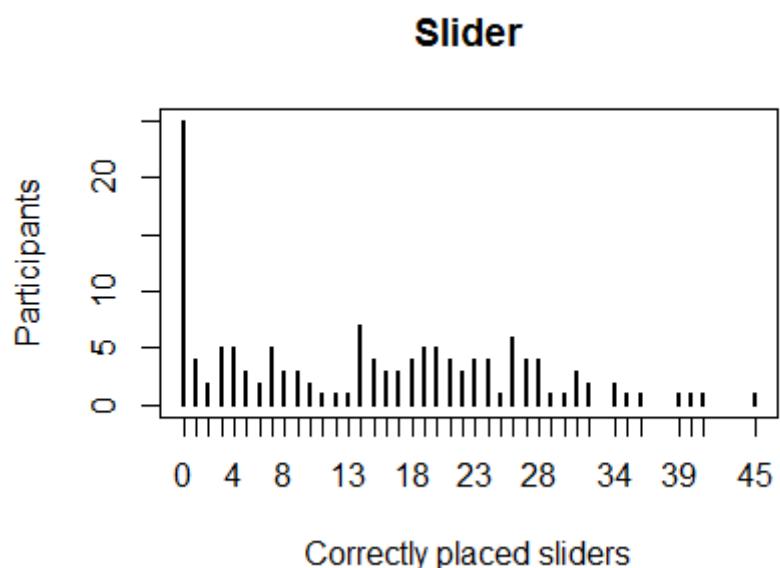
Figure C.2: Distribution of correctly placed sliders

Table 7: Correlation slider and anagram task

	Dependent variable:
	Anagrams
Slider	0.092*
	(0.053)
Constant	15.032***
	(0.976)
Observations	138
R^2	0.022
Adjusted R^2	0.015
Residual Std. Error	7.165 (df = 136)
F Statistic	3.046* (df = 1; 136)

Note: *p<0.1; **p<0.05; ***p<0.01

D   Anagramms

Table 8: Differences-in-differences regression

	Dependent variable:
	values
dummy_ana	3.215***
	(0.809)
dummy_tc	−0.646
	(0.802)
interaction	1.035
	(1.129)
Constant	7.396***
	(0.575)
Observations	220
R^2	0.172
Adjusted R^2	0.161
Residual Std. Error	4.183 (df = 216)
F Statistic	15.001*** (df = 3; 216)

Note: *p<0.1; **p<0.05; ***p<0.01
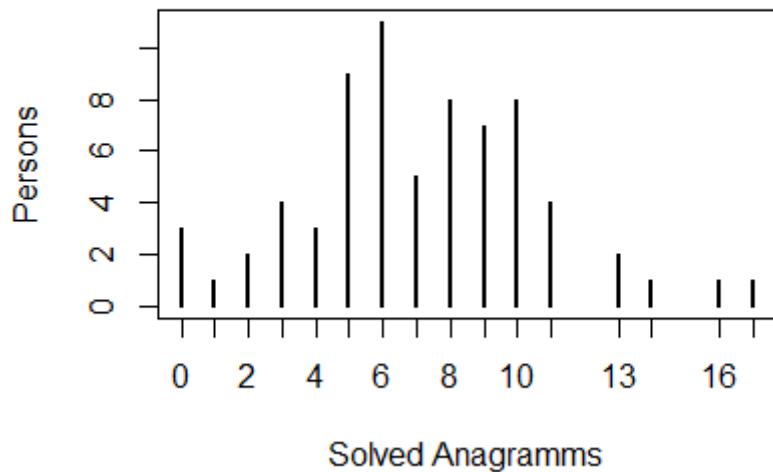
Figure D.1: Distribution of correctly solved anagrams
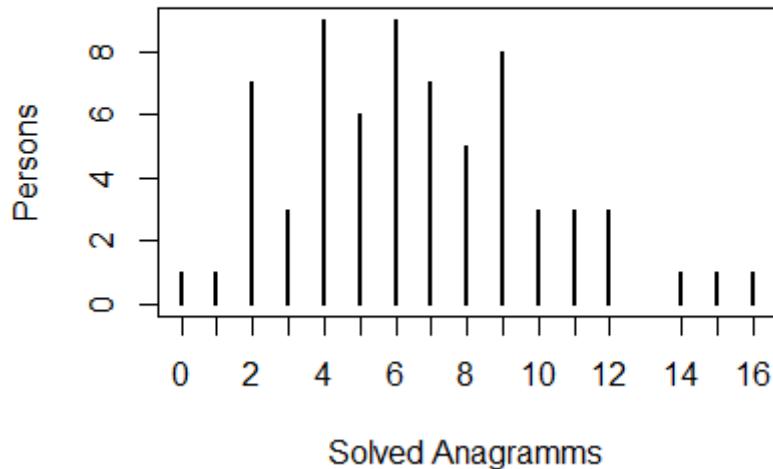
Figure D.2: Distribution of correctly solved anagrams
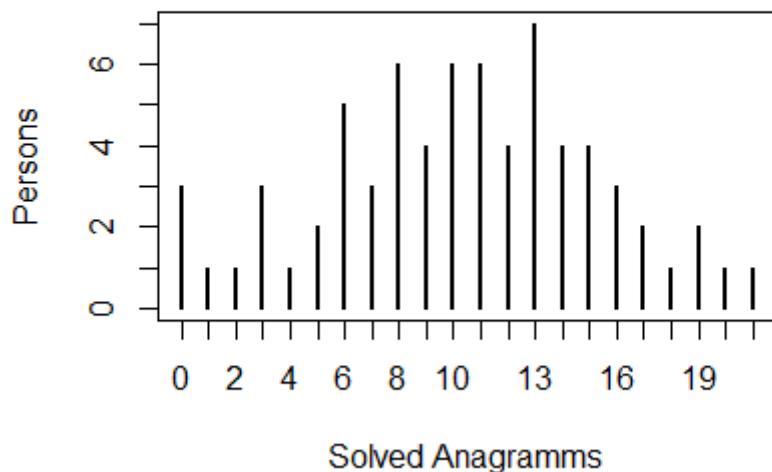
Figure D.3: Distribution of correctly solved anagrams
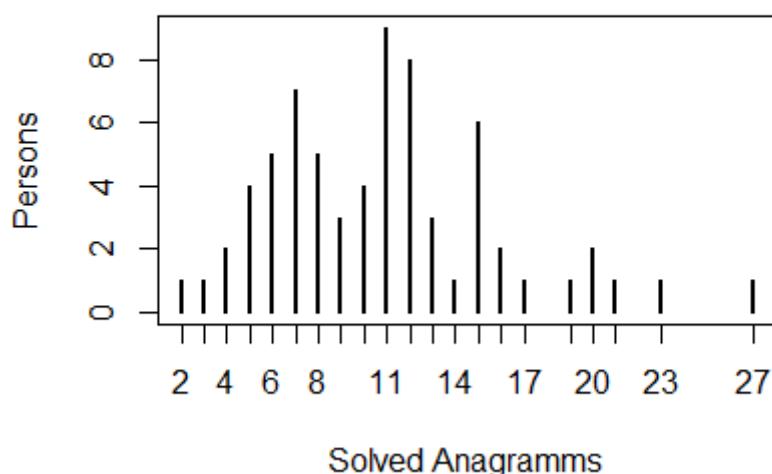
Figure D.4: Distribution of correctly solved anagrams

Corrected anagrams with solutions

```
-heer-
"Ehre" heer here rhee   reh reeh "Rehe" "eher"    "rehe" "ehre"
   1    1    1    1    3    4    4    26       32     38
-lief-
leif lief rief eifl "feil"   "fiel"
   1    1    1    2   10       99
-elke-
"Klee" elke    k keel kele "klee" "ekel"
```

15

```
    1     2     2     2     6    16      39
-elis-
 eils leise  "Lise"      s  seile  seli  leis  "ilse"  "lise"  "lies"  "seil"
    1     1     1         1     1     1     2     3       4      25      28
-heilt-
  eilt heilen  peilt teihlt  leith  heilt  "hielt"  "leiht"
    1     1     1     1       2     3      12      24
-arten-
  arten   ertan  garten   narte species  tarnen  tarten  tenar       t  "tarne"  "raten"
    1       1      1        1       1       1       1      1        2      8      42
-angst-
   alt    asdf gangst  gastn     st  angst  "nagst"  sangst  "sangt"  "stang"
    1       1     1      1        1     2       3       4       5       5
-altes-
 alte   asd selta stael stela "tales" "laste" "tesla"
    1     1     1     1     1     1       2       6
-taler-
alert "Alter"  asdf atler retal later taler "alter"
    1     1     1     1     1     2     3    41
-stein-
 asdf  eins eisnt neist stein "niste" "niest" "einst"
    1     1     1     1     1     3      13      20
-segen-
 asdf gesen regen "senge" segen "enges"
    1     1     1     1       2     5
-reset-
  asdf  "ester"  "steer" tester  trese  teser  "reste"
    1       1       1       1      1       2       8
-spreu-
 asdf "pures" sprei Spreu "spure" uerps perus preus "super"
    1     1     1     1     1       1     2     6     7
-ortes-
  asdf  ortes  "roste"  "Sorte"  stoer  "Tores"  tortes  "tores"  "rotes"  "sorte"
    1       1     1        1       1       1        1       7      11      32
-uhren-
 asdf ehren uhren "ruhen" "huren"
    1     1     2    17      21
-natur-
 asdf    la "traun" turan
    1     1     1     2
-nadel-
 asdf "Lande"  adel "Laden" nadel "lande" "adeln"    "laden"
    1     1     2     2       2     6      12      63
-mauer-
 asdf lauer mauer "maure"   r raeum rauem  raum reuma "raume"
    1     1     1     1       1     1     1     1     2     3
-marge-
"argem"  asdf "mager" "grame" marge
```

16

```
     1       1       1       2       2
-lager-
 asdf "erlag" "Regal" "regal"
     1       1       2      33
-geräte-
 ärgere  ärgert    asdf   träge "träger" erträge  geräte   gräte
     1       1       1       1       1       2       2       3
-sterne-
   asf "ersten"  sterne "nester" "ernste"
     1       2       2       6       7
-geisel-
  asdf "Gleise"   segel  eisgel  geisel "gleise" "siegel"
     1       1       1       2       2       3       8
-streit-
  asdf  reitst  treist "stiert"
     1       1       1       2
-stiele-
  asdf  stiele "steile" "leiste"
     1       2       8      16
-ostern-
  asdf "sorten" "storen"  ostern "rosten"
     1       1       1       2       7
-deines-
  asdf  deines  meines "seiend"  senide "sieden" "seiden" "neides"
     1       1       1       1       1       1       2       3
-karten-
asdf
   1
-garten-
   asf "graten"  harten  targen  garten "ragten" "tragen"
     1       1       1       1       2       3      13
-traube-
  asdf "betrau" "raubet"  traube "raubte"
     1       1       2       2       8
-taster-
   asdf   laster       r    raste  satter  starter "stater"  taster "starte"  raster "rastet"
     1       1       1       1       1       1       1       1       2       5       5
-tusche-
  asdf "suchet" "suchte" "scheut"
     1       2       3       6
-meisen-
  asdf     ein   imens  meines  meisen  niesem "seimen" "miesen" "seinem"
     1       1       1       1       1       1       1       6       6
-letzte-
  asdf "zeltet"  letzte "zettel"
     1       1       2       3
-deinen-
   asf  deinen  deinen   "einend" "dienen" "neiden"
```

```
     1        1        1        1        6           6
-bürste-
  asdf      r "brüste"
     1      1       6
-tieren-
   asdf   nieren   nierte  rentier  "Rieten"  tieren  "rieten"  "reiten"
      1       1        1        1        1       1        8          20
-taumel-
  asdf baumel "lautem"  taumel  "maulte"
     1      1      1        1        2
-spatel-
   asf patels "spalte"  spatel  "stapel"  pastel
     1      1       1        1        2         3
-schrot-
  asdf trosch "storch"
     1      1        2
-bier-
bier brie iber vier "brei" "reib"    "rieb"
   1    1    1    1    11    31          54
-beil-
heil "blei"   "lieb" "leib"
   1    3        38     79
-atem-
 ,ate "amte" atmen  "atme"  tema  "mate"  "team"  "meta"
     1      1      1      2      2     15        21      41
-adel-
    e      l laden "leda" "deal"    "lade"
    1      1      1      1       4         65
-geäst-
 "gesät"  tsäeg sägest  stäge  "säget"  "sägte"  "gäste"
     1      1      2       2       4        5          45
-genie-
 "eigne"    ein  einge  einig  engie  geine   neig neigen  niege "eigen" "neige"
     1      1      1      1      1      1      1      2       3       20      33
-geier-
 "eiger"  geier  greie  regier  reieg  rigee  reige  "regie"  "giere"  "riege"
     1      1      1      1      1      1      7      8          12         13
-garbe-
arberg  bager  narbe  "gebar"  "ergab"  "barge"  "grabe"
     1      1      1      2       3        4          10
-euter-
 gäste retue reuter  tuere  "reute"  "treue"        "teuer"
     1      1      1      1       6        6             91
-osten-
 etons  netso posten  stoen tosten  "steno"  "tosen"
     1      1      1      3      3     17        25
-enkel-
"ekeln"    enkel  kleen  lekne lenken  "ekeln"  "nelke"  "lenke"
```

```
        1       1       1       1       6      10          10          43
-eklat-
kaelte  tekla   "takel"  "kalte"
     1       2       4      11
-eifel-
 feilen  feileq    lefie zweifel    feiel    "fiele"     "liefe"        "feile"
      1       1       1       1       2       8          10             61
-eiern-
feiern nieren "reine"    neier  "einer"   "reien" reiern  "reine"  "niere"
     1       1       1       2       3       7       7          13          26
-eides-
 deins  idees seides  "siede" dieses  "diese"  "seide"
      1       1       1       1       2      17          42
-ebers-
beers rebes "erbse" "serbe"
     1       1       2      15
-biere-
ereieb  liere   "riebe"      "reibe"
      1       1      12          64
-berta-
   aber  atrea baerte  berat   "brate"  "barte"  "trabe"
      1       1       1       1       2       3          12
-belag-
"bagel" belag galbe blage "balge" "gabel"
     1       1       1       2       5      22
-schar-
archs    ars   rasc "arsch" "rasch"
     1       1       1       7      50
-basel-
     a elbas  hasel labes selba sabel "blase" "salbe"
     1       1       1       1       1       3      15      26
-ferien-
    fri  friere frieren  "freien"   "eifern"   "riefen"   "reifen"   "feiern"
       1       1       2       3       4       4          10          25
-schrei-
  reis reisch riesch rische "reichs" "schier" "schrie"
      1       1       1       1       2       2          16
-filets-
"liftes" steifl   stife stifel
     1       1       1       1
-steuer-
     a ersteu  rueste   streu sturee   teuer teuser "treues" reuste teuers euerst "teures" "streue"
     1       1       1       1       1       1       1       1       2       2       3       3       4
-erneut-
neuter "treuen" "eutern" "teuren" "teuern"
     2       2       3       3          5
-eigner-
erneig  geier "gieren" "greine" "neiger" "geiern" "reigen"
```

```
        1        1        1        1            1            3            9
-eifers-
feiers seifer "reifes"
    1        2        4        95
-diener-
    a   einer erdien riende "neider" "nieder" "deiner"
    1        1        1        1        6        10            19
-bieter-
breiter   dieter   "reibet"   teiber   tieger   trieb   "breite"   reibte   tieber   "triebe"   treibe
    1        1        1        1        1        1        2        2        3        3        4
-bauern-
erbauen   erbaun   mauern   narbe   "brauen"   "rauben"
    1        1        1        1        4        9
-günter-
ergünt "grünet" "gütern"
    1        1        1
-garben-
    a bagern   baren bergab       er   narbe "bargen" "graben"
    1        1        1        1        1        1        5        25
-eliten-
nieten "leiten" "eilten" "teilen"
    1        3        12        18
-riemen-
enriem meiren       rei "meiner" "reimen"
    1        1        1        3        9
-berste-
eberst "strebe" "bester" "sterbe"
    1        1        2        12
-donner-
donner dornen "ronden" "norden"
    1        1        1        8
-diesel-
 diesel zwiesel  "leides"  "seidel"  siedel
    1        1        2        2        5
-kleien-
 eikeln  "keilen" kleinen  "kleine"
    1        1        1        9
-insekt-
"sinket" sektin
    1        2
```

E White Bear

Table 9: t-test white bear

	t
Test statistic	-0.3614061
DF	113.662
p-value	0.7184668
Mean treatment Group	383.4688
Mean control Group	397.7500

Welch Two Sample t-test

Examples of the thought suppressing task

Wald Wetter einkaufen [...] was weiß ich mir fällt nichts mehr ein [...] frauen kinder männer ich darf nicht an einen weißen bär denken grüner bär roter bär blauer bär wieso nur ein bär nicht gummibäären bruno der bär schnappi das krokodil ich frag mich ob ich geisteskrnak bin das macht keinen sinn es blinkt [...]

Der raum ist weiß die Tastaturen klimpern ist das ein Chat? Komisches Experiment Was soll ich hier in die Box schreiben? Ich hoffe ich habe die Aufgabe richtig verstanden! Ich habe noch nie so im Detail über meine Gedanken nachgedacht warum soll ich meine Gedanken aufschreiben! Ich frage mich, wie lange das Experiment noch dauert Gott sei dank habe ich nur noch eine Minute auf dieser Aufgabe Aufgabe 1 war lustg soll ich immer noch etwas schreibe? Was ist, wenn ich an überhaupt nichts denke?!

Ich gehe durch den Zoo und stehe vor dem Gehege mit den Braunbären ich beobachte sie sie sind groß, braun und sehen gefährlich aus ich mag Tiere mit braunem Fell und ich mag Bären die braunen Bären mag ich und die Farbe braun sowie viele andere braune Tiere zum beispiel manche Pferderassen Rehe Hirsche braune Affen Kamele und viele braune Tiere, die man im Zoo so sehen kann + auch Löwen sind braun, Kangarus auch, Hunde können auch braun sein Es gibt viele Farben für Tiere Bären können auch schwarz sei

Warum habe ich bei den Anagrammen null Punkte bekommen? [...] Gleich gehe ich in die Mensa zum Mittagesse Hoffentlich gibt es dort nicht wieder so schlimmes essen Letzte Woche waren die Chicken-Taler wirklich grässlich Danach habe ich noch 3 Stunden Vorlesung - wo soll das nur enden? Immerhin ist die neue Staffel der Netflix Serie Orange is the new black rausgekommen Der Abend ist damit gerettet Dazu kann ich dann noch die 3 Kilo Kalbschnitzel verbraten, die noch von gestern Abend in meinem Kühlschrank liegen Leider hat die Metzgerfrau sie etwas dick geschnitten, sodass sie mir nicht so richtig gelungen sind Egal, muss ich sie heute einfach noch flacher kloppen

Tastatur Korbi Pulli Lautes Geklimper Wetter Uniliga Hübsche Blondine hinter mir Arme Handy PC Meer Eiszeit Gletscher Sieben leer Tisch Hübsche Blondine hinter mir Armband Haargummi Dell IntelCore Trennwand Wo sind die Süßigkeiten? Dell Prosupport stuhl friseur braunhaarige neben mir auch ganz nett Staub Braunbär Eisenbahn Tasche Teppich Decke Schlafen

Kokusnuss [...] James Bond 7 Waffee Bösewicht [...] Zeitmaschine Geheimwaffee Stalin Russen Russland Putin Merkel [...] Harry Potter Dumbledore Lord Voldemore Zaubereiministerium Die Kammer des Schreckens Hermine Hagrid Snape Computer Schlangensprache Hogwards

Ich denke an Dunkelheit um die Konzentration zu halten. ein haus kommt in den sinn, ein Berg. kein weißer bär. jetzt doch. das meer. zunah an eisbären. dunkelheit und sterne astronomie. eine kindesleidenschaft. ich frage mich ob ich die aufgabe richtig verstanden habe. ich denke weiter, nicht an den weißen bär. verdammt. [...]

warum? sind braune bären schöner? ich denke die gibt es nur am nordpol was auch immer pinguine sind eh viel cooler [...]

Ich kann nur an einen weissen bär denken oder er ist rot er läuft in alaska und hat einen fisch im maul sein weißes fell ist ganz rot vom blut des fisches und der bär trabtdavon nicht an den weissen bär denken ich denke an meer wasser insel palme wieso palme ein en affen und eine kokosnuss und ein b är , der die kokosnuss ist der bär schwimmt nun in der karibik mit einer kokosnuss und einem affen auf dem kopf richtung südametrika in südamerika wird aus ihm ein büffeö l büffel und bär laufen nach chile der bär ist jetzt braun

weißer Bär weißer Bär weißer Bär weißer Bär weißer Bär weißer Bär brauner Bär lila Bär weißer Bär Bier weißer Bär weißer Bär Bier weißer Bär Brüste weißer Bär weißer Bär weißer Bär weißer Bär weißer Bär Kaffee weißer Bär weißer Bär weißer Bär nochmal Brüste weißer Bär weißer Bär weißer Bär weißer Bär weißer Bär weißer Bär Bier Brüste Kaffee weißer Bär weißer Bär weißer Bär weißer Bär

[...]langweilig gleich ist es vorbei [...] ich meditiere ommmmmmmmmmmmmm ommmmmmmmmmmmmmmmmm ommmmmmmmmmmmmmmmmmmmmm ommmmmmmmmmmmm naja, bin nicht so der meditiertyp dell prosupport ui, was da wohl alles auf dem rechner steht und tolle aufkleber sind auch drauf

ich darf nicht an den weißen bär denken die straße ist laut mist, schon wieder an den weißen bär gedacht grad fährt ein zug vorbei alle denken an den weißen bär ich weiß nicht, was ich noch schreiben soll alle tippen wie wild der blöde weiße bär! ich denken an einen großen weißen Eisbären!! und an ein kuscheltier, das ich als Kind hatte - es war ein weißer Eisbär! Im nürnberger Zoo gabs mal so süße Eisbär Babys die waren aber eher braun als weiß jetzt denke ich an einen braunen Bär und an schöne grüne Wiesen und Wälder - da leben Bären nämlich Und sie essen Honig und klauen den aus Bienenwaben =)

[...]keina ahnung was ich hier mache das ist eigentlich ein kinderwitz eigentlich würde ich jetzt gerne schlafen ich frage mich was das soll ich hoffe einfach mal, dass ich pro aussage taler verdine taler taler taler taler taler eigentlich habe ich viel zu tun aber immerhin gibts hier essen ich denke grade daran dass das hier wahrscheinlich irgendeiner liest und sich nur so denkt wtf? [...]

References

Baumeister, R. F., E. Bratslavsky, M. Muraven, and D. M. Tice (1998). "Ego depletion: is the active self a limited resource?" In: *Journal of personality and social psychology* 74.5, pp. 1252–1265.

Baumeister, R. F., M. Gailliot, C. N. DeWall, and M. Oaten (2006). "Self-regulation and personality: How interventions increase regulatory success, and how depletion moderates the effects of traits on behavior". In: *Journal of Personality* 74.6, pp. 1773–1801.

Gailliot, M. T., E. A. Plant, D. Butz, and R. F. Baumeister (2007). "Increasing self-regulatory strength can reduce the depleting effect of suppressing stereotypes." In: *Personality and social psychology bulletin* 33.2, pp. 281–294.

Gordijn, E. H., I. Hindriks, W. Koomen, A. Dijksterhuis, and A. Van Knippenberg (2004). "Consequences of stereotype suppression and internal suppression motivation: a self-regulation approach." In: *Personality and social psychology bulletin* 30.2, pp. 212–224.

Muraven, M and R. F. Baumeister (2000). "Self-regulation and depletion of limited resources: does self-control resemble a muscle?" In: *Psychological bulletin* 126.2, pp. 247–259.

Muraven, M., R. F. Baumeister, and D. M. Ticea (1999). "Longitudinal Improvement of Self-Regulation Through Practice: Building Self-Control Strength Through Repeated Exercise". In: *The Journal of Social Psychology* 139.4, pp. 446–457.

Oaten, M. and K. Cheng (2006). "Longitudinal gains in self-regulation from regular physical exercise." In: *British journal of health psychology* 11.Pt 4, pp. 717–733.

Oaten, M. and K. Cheng (2007). "Improvements in self-control from financial monitoring". In: *Journal of Economic Psychology* 28.4, pp. 487–501.

Schmeichel, B. J., K. D. Vohs, and R. F. Baumeister (2003). "Intellectual performance and ego depletion: role of the self in logical reasoning and other information processing." In: *Journal of personality and social psychology* 85.1, pp. 33–46.

Schwarzer, R. and M. Jerusalem (1995). "Generalized Self-Efficacy scale." In: *Measures in health psychology: A user's portfolio. Causal and control beliefs*, pp. 35–37.

Schwarzer, R. and M. Jerusalem (1999). *Skalen zur Erfassung von Lehrer- und Schülermerkmalen. Dokumentation der psychometrischen Verfahren im Rahmen der Wissenschaftlichen Begleitung des Modellversuchs Selbstwirksame Schulen.* Vol. 38. 158, April, p. 101.

Vohs, K. D. and T. F. Heatherton (2000). "Self-Regulatory Failure: A resource-depletion approach". In: 21, pp. 249–254.

Wegner, D. M., D. J. Schneider, S. R. Carter, and T. L. White (1987). "Paradoxical effects of thought suppression." In: *Journal of personality and social psychology* 53.1, pp. 5–13.