The Influence of Product Presentation on Willpower

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Abstract

This study was designed to compare the list and matrix product presentation formats in terms of the depletion of willpower during a shopping task in an online music store.

A total of *N*=185 participants were distributed to one of four groups and completed the online study. The groups differed whether they were ego-depleted by a Simon-task before the shopping task or not and whether they performed the shopping task with the list or the matrix product presentation format.

Due to low task compliance in the online music store a lot of participants had to be excluded from the analysis resulting in a sample of *N*=65 participants with only low statistical power. Therefore, the research question could not be answered conclusively. The low task compliance was investigated but no valid conclusion could be drawn from the collected data to explain it. Therefore, further studies with higher statistical power are required to answer the initial research question and the occurrence of low task compliance in online studies, especially on the topic of willpower.

The Influence of Product Presentation on Willpower

E-commerce is growing constantly and rapidly also in Switzerland (vsv-versandhandel.ch, 2016). However, online shopping has not only provided a new platform for the expansion and growth of business it appears to be completely different in terms of how customers determine to buy a product (Alba et al., 1997; Butler & Peppard, 1998). Unable to interact with a product as it would be possible in traditional retail stores, the product presentation in online stores becomes the main source of product information. Lohse and Spiller (1998) tried to quantify the effects of product presentation pages and claimed that they account for 61% of the variance in monthly sales. Therefore, the product presentation format is crucial for the customer behavior. Another important role in consumer behavior seems to be played by willpower (Baumeister, 2002). Depleting willpower seems to results in a larger urge to buy products and a higher amount of money being spent on products (Vohs & Faber, 2007).

Although willpower and the product presentation page both seem to be important for the buying process of products in online stores, the combination of the two has not been investigated yet by previous research. We would like to change that with this study.

Based on findings by Schmutz, Roth, Seckler, and Opwis (2010) that customers with a list product presentation format made more cost-benefit selections and therefore spent less money in an online grocery store than customers with a matrix product presentation format, we would like to answer the specific question, whether the list and matrix formats of product presentation require different levels of willpower during a simple online shopping task.

Therefore, we designed an online study that manipulated willpower and product presentation format. The theoretical background that led to the study design and our hypotheses will be presented first. Then we will explain the study design and procedure before finally presenting the results and their discussion.

Theoretical background

First, to be able to understand the role of willpower, the overarching concept of self-control also known as self-regulation is defined. Second, the concept of willpower and the ego-depletion state are summarized. Then, the distinctiveness of willpower to other constructs and the role of willpower in consumer behavior are discussed. Finally, findings of previous comparisons between product presentation formats are presented.

Self-control

"*Self-control* is the exertion of control over the self by the self. That is, self-control occurs when a person (or other organism) attempts to change the way he or she would otherwise think, feel, or behave." (Muraven & Baumeister, 2000, p. 247). The definition makes it conspicuous that self-control affects multiple parts of our daily lives. Whenever we deliberately take or omit an action against an urge, we make use of self-control.

Baumeister and Vohs (2007) named four main components of self-control: The first component is standards, which we try to bring ourselves into line with by using self-control. The second component is monitoring to allow us to keep track of ourselves and detect if we are not in line with our standards. The third component is motivation to meet the standards or to achieve goals by using self-control. Ultimately, the fourth component is willpower, the self-regulatory strength we need to overcome the difficulties of changing the self. For this study, we set the focus on the component willpower.

Willpower is believed to have limited capacity and that certain actions diminish this capacity (Baumeister, Bratslavsky, Muraven, & Tice, 1998). Such actions include controlling attention, emotions, impulses, thoughts and cognitive processing as well as choice, volition and social processing (Baumeister, Vohs, & Tice, 2007).

Like a muscle, after being used willpower is temporarily impaired (Muraven &

Baumeister, 2000). This state is called ego-depletion and temporarily leads to a hangover effect on following tasks that require willpower resulting in lower self-control during these tasks (Baumeister et al., 1998). For this to happen, the willpower capacity does not necessarily have to be used up completely. Muraven (1998) found that the state of ego-depletion is already caused by the attempt of the self to conserve willpower. The full capacity can be restored by rest and especially sleep (Baumeister, Muraven, & Tice, 2000). To re-utilize the muscle analogy, the frequent use of willpower is believed to increase the maximum capacity like a muscle's training would increase its maximum strength (Muraven, Baumeister, & Tice, 1999). It is also important to note that positive affect (Tice, Baumeister, Shmueli, & Muraven, 2007), autonomy (Moller, Deci, & Ryan, 2006), high motivation (Muraven & Slessareva, 2003) and personal beliefs (Job, Dweck, & Walton, 2010) contribute to self-control and prevent the state of ego-depletion to a certain degree.

How does willpower distinguish itself from other constructs?

Motivation. Heckhausen (2012) described motivation as a tendency that directs, amplifies, initiates as well as terminates, coordinates and delineates the cognitive and motor processes. Therefore, it seems tempting to interpret certain research findings as an indication that ego-depletion is in fact just a state of motivation (Baumeister & Vohs, 2007).

However, as mentioned above, Baumeister and Vohs (2007) included motivation as one of the four components of their theory of the self-control process. Further, they describe the four components as ingredients, of which each is necessary for effective self-control but they are able to compensate or substitute each other to a certain degree. Nevertheless, the components are not equally well at compensating for others. Motivation, for example, is believed to be especially effective at substituting for willpower but not for the lack of a clear standard (Baumeister & Vohs, 2007). For example, when given an incentive such as money, a previously induced effect

of ego-depletion can be erased (Muraven & Slessareva, 2003). Conversely, it would be hard even for a highly motivated person to use self-control without knowing which standard to be in line with.

As a consequence of the high substituting effectiveness, a moderating effect on willpower has to be expected and controlled in our study. Although, Vohs, Baumeister, and Schmeichel (2012) found, that only mild levels of ego-depletion can be substituted by motivation, motivation levels in our study should only be insignificantly different between groups and ego-depletion should be severe enough to prevent the substitution of willpower by motivation in a follow-up task.

Cognitive load. Similar to willpower, cognitive load is also based on the assumption of a limited resource (Vohs et al., 2014). Cognitive load prevents the ability to use the full information processing capacity that would be available otherwise. In other words, when two tasks are performed simultaneously, increasing the performance of one task decreases the performance of the other due to cognitive load (Sweller, 1988, 1989).

However, no hangover effect on attention can be observed on a follow-up task like the state of ego-depletion for willpower. The effects of cognitive load disappear as soon as cognitive load is no longer present. There are some attention-related hangover effects in form of attentional blindness (Raymond, Shapiro, & Arnell, 1992) or repetition blindness (Kanwisher, 1987), but both peak and dissipate quite rapidly (Vohs et al., 2014). In contrast, Vohs et al. (2014) reported that ego-depletion effects can last from a few minutes to up to 45 minutes after the initial use of willpower.

Therefore, we will make use of the distinctive hangover effect of willpower in our study to make sure we indeed measure effects of willpower and not of cognitive load. Additionally, the dependent variable should be measured after the task to prevent unwanted effects from cognitive

load.

Mental fatigue. When mental resources are used, subjective fatigue is to be expected (Cameron, 1973). Furthermore, the use of willpower appears to coincide with subjective feelings and physiological indicators of fatigue (Hagger, Wood, Stiff, & Chatzisarantis, 2010). When induced by prior tasks, mental fatigue also decreases performance in a follow-up task and resources can be restored by rest or sleep as it is the case for ego-depletion. However, ego-depletion does not seem to be just fatigue (Vohs, Glass, Maddox, & Markman, 2011). Unlike ego-depletion, fatigue can be induced by simple and uncontrolled processes and to become mentally fatigued a much longer task performance period up to several hours is required (Vohs et al., 2014). In comparison, ego-depletion can be induced by manipulations that require less than ten minutes (Vohs et al., 2014).

In order to be certain that we capture the effects of ego-depletion and not of mental fatigue the task duration should not be prolonged unnecessarily in our study.

The role of willpower in consumer behavior.

Consumer behaviour is able to provide useful insights in human nature and allows the observation of many distinctively human patterns of cognition and behaviour (Baumeister, Sparks, Stillman, & Vohs, 2008). It is also an interesting research topic in terms of willpower and the effects of ego-depletion and has several practical implications. For example, a shopping tour requires multiple decisions in form of choices or whether a product should be bought or not. This can be ego-depleting because making choices or decisions seems to reduce self-control (Vohs et al., 2014). Additionally, the act of purchasing or the purchase of a particular item sometimes feels irresistible even if it is inconsistent with one's long-range goals, ideals, resolves and plans and is therefore expected to require self-control (Baumeister, 2002). Thus, people in the state of ego-depletion are more likely to make impulsive purchases. The reason for the urge to buy things

could be a goal conflict with affect regulation (Tice, Bratslavsky, & Baumeister, 2001). When people are in a bad mood, they generally wish to feel better as soon as possible, even if this short-term goal stands in conflict with their long-term goals (Tice et al., 2001). At least temporarily, making a purchase in these situations is expected to result in a more positive mood of the buyer due to the effect of self-gratification (Tauber, 1972). However, while both negative and positive affect can increase impulsive buying tendency (Rook & Gardner, 1993; Youn & Faber, 2000), positive affect has also been found to counteract the effect of ego-depletion (Tice et al., 2007). Additionally, different affective states are also expected to result in different severities of the urge to purchase and therefore require different levels of willpower to withstand. Because of the influence of affect on ego-depletion and impulse buying, affective state should not be significantly different between the groups in our study.

Research also discusses buying impulsiveness as a consumer trait variable (Rook, 1987). Nevertheless, almost everyone has experienced occasional impulse buying and even impulse buyers can control their buying impulses at times (Vohs & Faber, 2007). More important is the necessity to measure buying impulsiveness on a product-specific level, because involvement with the product seems to play a crucial role when having to control impulse buying tendencies (Jones, Reynolds, Weun, & Beatty, 2003). Product involvement describes the subjective relevance of a product based on a person's inherent needs, values, and interests (Zaichkowsky, 1985). In our study, groups should therefore only differ insignificantly in the consumer trait buying impulsiveness when comparing the influence of willpower on impulsive buying tendencies and the chosen product should have to be involving for the potential buyer.

Willpower also has an effect on how much money people are willing to pay for a product (Vohs & Faber, 2007). Participants who were ego-depleted by a previous task were later willing to pay a higher price for a variety of products than participants that were not ego-depleted (Vohs

& Faber, 2007). Vohs and Faber (2007) were also able to show that this finding applies to actual purchasing behavior and that ego-depleted participants had a significantly higher urge to spend all the money they were given.

Product presentation.

The most popular product presentation formats among e-commerce websites seem to be the list and matrix format (Schmutz et al., 2010). Both formats can be described as tables: While the list format contains only one product per row, the matrix format allows the display of multiple products in a row.

Depending on the customers shopping objectives either the list or matrix product presentation format seem to increase performance in terms of a lower task completion time (Hong, Thong, & Tam, 2004a). For example, customers performed better with the matrix product presentation format when they were looking for a specific product whereas the list format allowed for a better performance when customers were browsing to find a product of their own choice and was favorable for the recall of product information (Hong et al., 2004a). In addition, the customer's attitude towards the screen design did not differ between list and matrix product presentation format but showed a significant preference to use the list format (Hong, Thong, & Tam, 2004b).

A possible explanation for the performance differences found by Hong et al. (2004a) is provided by the proximity compatibility principle (Barnett & Wickens, 1988). The principle states that when information is used for the same task it should be displayed closer together and in a similar way. On the other hand, when information is not used for the same task it should not be displayed close together and in a different way. Thus, a list product presentation format is more suitable for a product comparison, because the product information is used for the same task and is displayed closer together.

In line with the proximity compatibility principle Schmutz et al. (2010) found a lower cognitive load for the list format when conducting a comparison task. In addition, the customers with the list presentation made more cost-benefit selections and therefore spent less money in the online grocery store (Schmutz et al., 2010). Based on the findings of Vohs and Faber (2007) this could also be an indication, that a comparison task with the list product presentation format is less ego-depleting than with the matrix product presentation format and therefore less money was spent.

Prior research did not yet address the question whether or not product presentation formats differ in terms of depleting willpower during an online shopping task. We therefore address this research question in the current study.

Research questions and hypotheses

From the theoretical background the research questions arose, whether different formats of product presentation in an online shop require different levels of willpower during a simple shopping task. Specifically, we designed an online study to compare the levels of ego-depletion after a comparison task in an online shop with either a matrix or list product presentation format. Based on the findings of Vohs and Faber (2007) following hypotheses were made:

Compared to groups without ego-depletion, groups that were previously ego-depleted report

H1a: a higher amount of money they would spend on the products.

H1b: a larger urge to spend more money than indicated.

Furthermore, due to the proximity compatibility principle by Barnett and Wickens (1988) and the reported results of Hong et al. (2004a) and Schmutz et al. (2010) we hypothesized:

The use of the matrix product presentation format is more ego-depleting than the list product presentation format resulting in

H2a: a higher amount of money participants would spend on the products.

H2b: a larger urge of the participants to spend more money than indicated.

Method

Experimental Design

The study used a 2x2 between-participants factorial design. The first independent variable was whether ego-depletion was induced in a first task or not (test vs. control group) and the second independent variable was the different shop layout in terms of product presentation (list vs. matrix). The dependent variables were the amount of money participants would be willing to spend on the products they were instructed to buy in an online shop and how large their urge was to spend more than what they indicated.

Participants

A total of *N*=185 participants completed the online study during a time period of one month. Participants were recruited via private Facebook accounts as well as Facebook groups of psychology students at the Universities of Basel, Zürich and Bern, a mailing list of the psychology department at the University of Zurich, a recruiting system for undergraduate students majoring in psychology at the University of Basel (BAPS) and a recruiting database of the human computer interaction research group of the University of Basel. The only recruiting criteria for participants were Swiss residency and they had to understand German. As compensation participants were able to take part in a voucher lottery or if they were psychology undergraduates of the University of Basel receive an acknowledgement for their study participation to gain course credits for their bachelor's degree. More detailed information about the participants can be found in the results chapter.

Materials

Simon-Task. To create two groups among all participants, one with induced ego-depletion and one without, a task making use of the Simon effect (Simon & Rudell, 1967) was used. According to Simon (1969), the effect requires participants to inhibit a "natural" tendency

to respond toward the source of stimulation" (p.174). Therefore, willpower is involved insofar as the participants must override their normal or automatic response (Muraven & Baumeister, 2000) and we hypothesized the task would cause ego-depletion like the more typically used Stroop-like tasks (Stroop, 1935).

Inspired by the *simple S-R overlap trials (Type 3)* used by Kornblum (1994), the stimulus material were white rectangles (284x142 pixel) with a black border (1 pixel). Inside the rectangles, on the right or left side, was either a blue or green square (142x71 pixel) as shown in Figure 1. Participants were instructed to press the left arrow key on the keyboard as fast as they could, if a blue square appeared on either side inside the rectangle. Equally, they had to press the right arrow key as fast as possible when a green square appeared on either side inside the rectangle. This created congruent and incongruent stimuli in terms of stimulus and response: Congruent when the blue square was located on the left side and the green square located on the right side of the rectangle as well as incongruent stimuli when the blue square was on the right side and the green square on the left side of the rectangle.

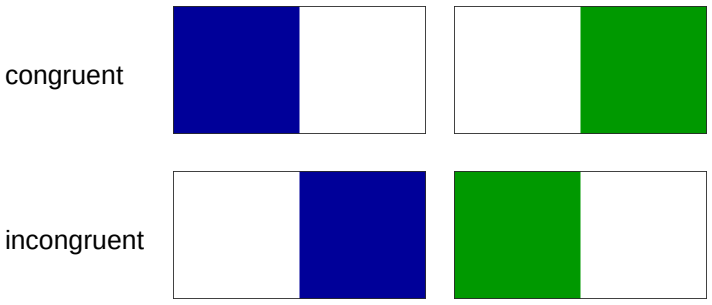

Figure 1. The stimulus material of the Simon task with congruent and incongruent stimuli.

The stimuli were presented using jsPsych (version 4.3), a JavaScript library to create behavioral experiments in web browsers (de Leeuw, 2015). The script displayed the different stimuli in randomized order for an equal amount of times and it prevented participants from anticipating the appearance of a stimulus by randomly changing the inter stimulus interval within

750 to 2250 milliseconds. Additionally, all the presented stimuli, key presses and reaction times were recorded for each participant. For the participants to get used to the task before the actual data collection started there was also a short trial phase over 8 stimuli presentations implemented with feedback on the average reaction time and accuracy during the trial phase.

The Simon effect would predict a higher average response time for incongruent stimuli than for congruent stimuli. As a manipulation check, to make sure participants executed the Simon-Task correctly, it was checked whether this prediction was met. For the manipulation check to be accepted participants were additionally required to answer at least 85 % correctly.

As a final step and to make sure the created Simon task induces ego-depletion as hypothesized, a pilot study was conducted. For this purpose a test group (n=10) with congruent and incongruent stimulus presentations was compared to a control group (n=10) with only congruent stimulus presentations. Participants and were assigned to the groups in alternating order and did not receive a compensation for the participation. For the first 10 participants the Simon task was performed with 300 stimulus presentations. However, after pilot testing the participants gave oral feedback indicating that the task took too much time and they would discontinue the experiment during an online study. Therefore, the stimulus presentations were reduced to 200 for the remaining ten participants in order to see if the previously obtained results would remain similar. After completing the Simon task, the participants were asked to perform a set switching task in paper-and-pencil format. In set switching tasks participants first learn an initial set of rules, which change during subsequent trials and therefore require the participants to inhibit previously learned rules (Duckworth & Kern, 2011). Specifically, a similar task as used by Baumeister et al. (1998) was used: For the first 5 minutes participants had to cross as many of the letter “e” (upper or lower case) in a text as they could. Afterwards, they were asked to do the same for the following 5 minutes, but if the “e” was the last letter of a word or if the next letter

was another vowel, they were not allowed to cross it as before. Indicating that the Simon task indeed induced ego-depletion, results showed a qualitatively higher amount of correctly crossed letters in the control than in the test group during the set switching task. Additionally, during the Simon task each participant in the test group showed a qualitatively higher average reaction time for incongruent than for congruent stimuli. Because similar results were observed with 300 and 200 stimulus presentations during the Simon task, the version with less stimulus presentations was used in the final online study.

Online Shop. Authentic online shops were designed to compare the two different product presentation formats in a believable environment and can be seen in Figure 2. Inspired by Hong et al. (2004a) the product presentation formats were either a matrix with three columns or a list. Both matrix and list presentation displayed six items before it was required to scroll.

Thematically, an online music store was chosen because of the high likeability of the product category by a large population (Suisa, 2009) and we therefore expected a high product involvement. A music store also allowed for a realistic measurement of the dependent variable in form of spending money, because there are online music stores that allow customers to determine the price they want to pay to download music themselves (e.g. Bandcamp). In addition, the same music titles can differ in details such as version or format and are therefore often displayed multiple times in search results of online music stores. This allowed for different items in the online shop that stayed almost identical in terms of visual appearance. Only the written descriptions had to be partially different between products on the same product page.

For the main study ten artists and song titles were made-up to prevent that possible knowledge of any songs or artists would interfere with the measurement of the dependent variables. Each of the ten music titles was available in four different versions (album, radio, instrumental, live) and two different file formats (WAV, MP3) resulting in 80 different shop

items overall. The eight different items for each music title were displayed as search results on ten different product pages. To make the shop simpler and less prone to errors, participants were able switch between product pages by clicking on navigation tabs named “Title 1” to “Title 10”.

As a cover story, participants were instructed to imagine they would be buying music as a birthday gift for a friend and that the songs were related to shared memories to increase involvement. For this reason, a shopping list containing ten music titles in a randomly chosen version and format was provided on the right hand side of the online shop (see Figure 2). Because the description of the music titles on the online shop product pages contained more information about the music titles than the shopping list, a passive inhibition of irrelevant information, a so called goal shielding, was required by the participants to complete the task (Hofmann, Schmeichel, & Baddeley, 2012). A passive rather than an active inhibition task was chosen because it seemed more realistic in an online shopping task and was therefore supposed to provide more practical implementations. Both active and passive inhibition tasks have been found to independently contribute to impulse control (Hofmann, Gschwendner, Friese, Wiers, & Schmitt, 2008). Additionally, a premade shopping list prevented autonomy during the shopping task to interfere with any ego-depleting effect of the shopping task (Moller et al., 2006).

To pass the manipulation check criterion in both product presentation formats participants had to put at least seven of the ten music titles on the shopping list into the shopping cart. This allowed making sure, people tried to complete the task as intended.

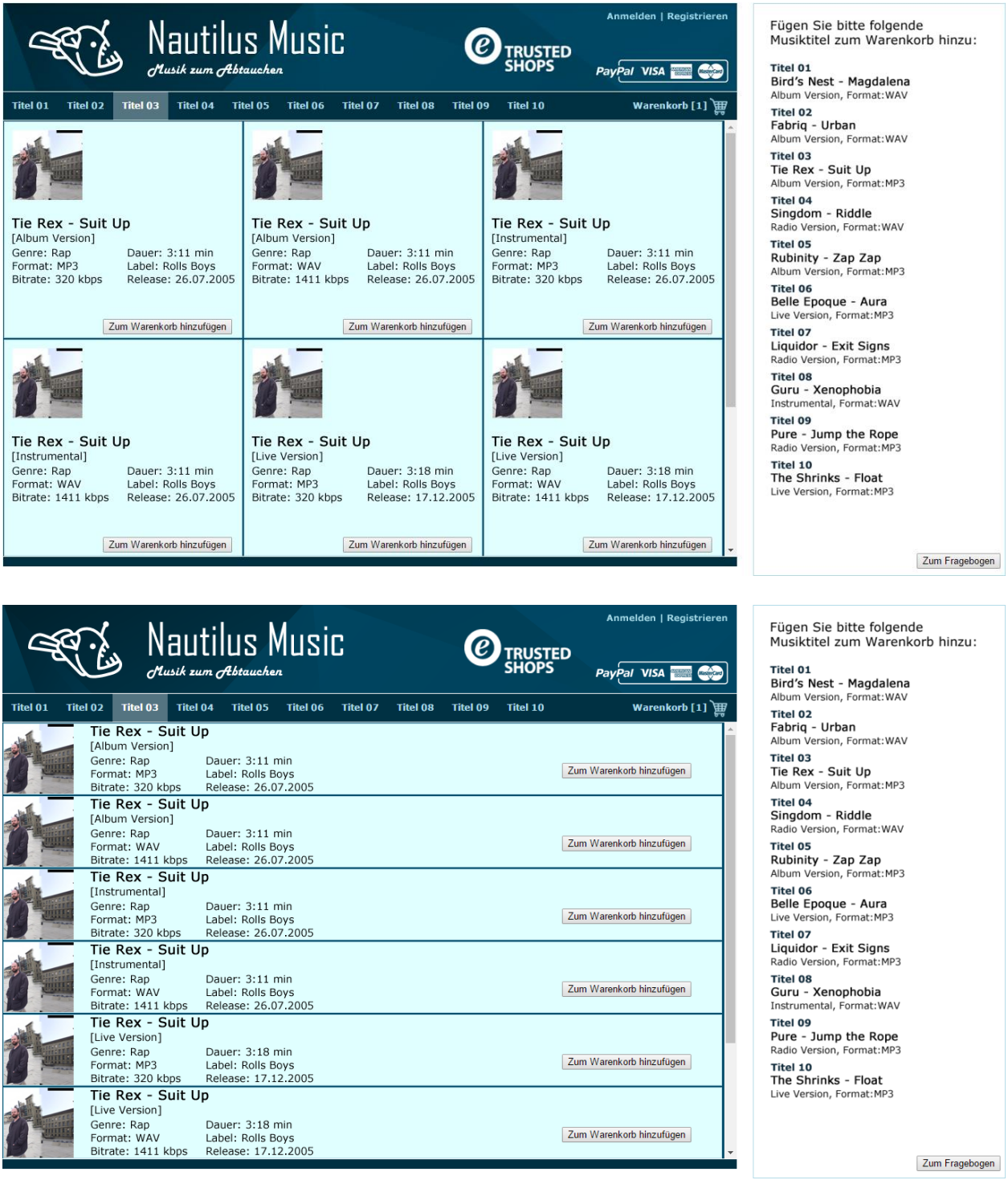

Figure 2. The used online shops with matrix product presentation format on top and list product presentation format at the bottom. Each shop had a size of 1366 x768 pixel with the shopping list included.

Measures

Buying Impulsiveness Scale (BIS). Rook and Fisher (1995) defined the trait variable buying impulsiveness as "a consumer's tendency to buy spontaneously, unreflectively, immediately, and kinetically" (p. 306). To measure buying impulsiveness Rook and Fisher (1995) designed the Buying Impulsiveness Scale (BIS). This instrument asks participants to rate their level of agreement with nine statements on a 5-point Likert scale ranging from 1 ("does not apply at all") to 5 ("fully applies"). For our study a German translation of the BIS (see Figure A1 in Appendix A) was used to make sure that there were no initial differences in tendencies for buying impulsiveness between groups that could have a moderating effect on our dependent variables. The internal consistency of the instrument was considered to be good, McDonald's omega = .88, 95% CI [.83, .91].

Task Difficulty. Participants rated how difficult it was for them to find the correct products in the online shop on a 5-point Likert scale ranging from 1 ("not at all") to 5 ("extraordinarily"). Similar to Vohs and Faber (2007) the task difficulty was assessed to provide a manipulation check for the ego-depleting effect of the different product presentation formats in the online shop.

NASA Task Load Index (NASA-TLX). The NASA-TLX is a questionnaire consisting of six different subscales to assess subjective workload (Hart & Staveland, 1988). The subscales are bipolar with verbally described endpoints (from "low" to "high" or "good" to "poor") to measure the experienced mental, physical and temporal demands as well as the performance, effort and frustration during the task completion. The original version of the NASA-TLX also includes a weighting of the different subscales. However, mixed results about the benefits of this subscale weighting have been reported (Hart, 2006). Nygren (1991) for example explicitly recommends ignoring it and Pfendler (1991) found improved differentiation and psychometric

properties for the German version of the NASA-TLX when omitting the weighting procedure. Thus, in our study we used the NASA-TLX in German provided by Pfendler (1991) without the weighting procedure. Participants rated the subscales on visual analog scales (VAS) which were recalculated to 20-point scales to detect potential differences in Cognitive Load during the tasks of the different groups (see Figure A2 in the Appendix A). The internal consistency of the instrument was considered to be good, McDonald's omega = .82, 95% CI [.76, .86].

Positive and Negative Affect Schedule (PANAS). Watson and Tellegen (1985) postulated a simple model that reduces all self-reported and observer-reported affects to two independent dimensions: positive and negative affect. Both dimensions of affect can influence impulsive buying (Rook & Gardner, 1993; Youn & Faber, 2000). For the evaluation of positive and negative affect Watson, Clark, and Tellegen (1988) provided the PANAS, which was adapted for the use in German by Krohne, Egloff, Kohlmann, and Tausch (1996). The PANAS is a questionnaire that asks participants to rate the extent to which they experienced 20 different emotions on a 5-point Likert scale. Depending on the given instructions it also allows to measure trait or state. In this study only the momentary state was measured to make sure groups did not differ in affect, which could have influenced the dependent variables. The internal consistency of the instrument was considered to be good for the positive affect scale, McDonald's omega = .87, 95% CI [.82, .9], and the negative affect scale, McDonald's omega = .83, 95% CI [.71, .91].

Budget. Participants were asked to enter a maximal amount of money they would spend on a birthday present of a friend to control for a possible anchoring effect (Tversky & Kahneman, 1974) on the dependent variables. This effect could have been caused by the cover story for the online shopping task.

Motivation. Their motivation to fill out the study conscientiously was rated on a 5-point Likert scale ranging from 1 ("very low") to 5 ("very high") by all participants. This allowed

examining whether very high motivation levels may have compensated for the lack of willpower in the state of ego-depletion.

Procedure

Initially, participants had to click on a link that took them to the web-based survey platform Unipark, where the study was conducted. The participants who read and accepted the informed consent were asked to enter their age in years and their gender. Then they were asked to fill out the BIS before being randomly directed to the Simon-Task with either congruent and incongruent or only congruent stimuli. After completing the Simon-Task participants were directed back to Unipark to read the cover story and were instructed how to use the online shop for the next task. Randomly assigned to one of the two product presentation formats participants then handled the shopping task on an external website. Once the shopping task was completed participants were directed back to Unipark and rated the task difficulty as well as the subjective workload during the task in the form of the NASA-TLX. In a next step, the PANAS was performed right before the amount of money participants would spend on the products and the urge to spend more than indicated were inquired. Participants then gave insights on further measurements such as the budget they would spend on a birthday present of a friend as well as the motivation and decided whether they honestly consider their data as useful for the study. In a final step participants were asked if they want to take part in the voucher lottery and if they were interested to be informed about the results of the study.

Results

The collected data was checked to meet the required conditions for the specific statistical tests: All variables other than gender were tested for normal distribution within groups using Shapiro-Wilk tests and homogeneity of variance using the Flinger-Killeen test to explore the assumptions necessary for an ANOVA. However, assumptions were never met and therefore non-parametric Kruskal-Wallis tests were used to evaluate significant differences between groups. Furthermore, an α-level of .05 was used for all statistical testing.

Participants

Exclusion Criteria. Out of the initial *N*=185 participants, ten participants were excluded, because in their honest opinion their data should not be used for this study. Another nine did not fulfill the Simon task criterion and five did not complete the study in a reasonable amount of time of less than 35 minutes and were therefore excluded as well. The last criterion to correctly put at least seven items from the shopping list in the shopping cart was only met by *N*=65 participants (see Table B1 in Appendix B). Therefore, with all initially required criteria only an explorative analysis was possible. However, for more statistical power the same statistical analyses were also performed using *N*=122 participants who met the minimal criteria of having placed at least one item in the shopping cart (see Table B2 in Appendix B). In addition, task compliance indicators from the shop tracking data such as amount of visited pages in the online shop, number of items and number of correct items added to the shopping cart or time on the task were analyzed.

Age. The average age among all *N*=65 participants was 28.89 years (*SD* = 9.06). A Kruskal-Wallis one-way analysis of variance indicated that age was significantly different among groups, $H(3) = 1.46$, $p = .02$. Further analysis using a post-hoc Dunn's test with Benjamini-Hochberg correction revealed significant differences in age between the control and test group with matrix product presentation format, $z = -2.47$, $p = .04$, as well as between the control groups

with matrix and list product presentation format, $z = 2.46$, $p = .02$.

The N=122 participants that fulfilled minimal criteria had an average age of 30.51 years (SD = 11.63). For this sample a Kruskal-Wallis one-way analysis showed no statistical significance for age differences between groups, $H(3) = 5.34$, $p = .15$.

Gender. Overall 39 females and 26 males participated in the study. To compare gender distribution between groups a chi-square test was performed but revealed no significant differences, $\chi^2(3, N=65) = 4.09$, $p = .25$. Another non-significant chi-square test lead to the same conclusion for the minimal criteria sample consisting of 77 females and 45 males, $\chi^2(3, N=122) = 1.65$, $p = .65$.

Manipulation Check

Task Difficulty. The perceived task difficulty was expected to provide a manipulation check for ego-depletion after using the online shop. We hypothesized it to be higher in test groups than control groups and higher in matrix than in list presentation format groups. In line with our assumptions a Kruskal-Wallis one-way analysis of variance indicated significant differences between groups, $H(3) = 9.03$, $p = .29$. However, a post-hoc Dunn's test with Benjamini-Hochberg correction revealed only significant differences between the control groups of the list and matrix presentation format, $z = 2.9$, $p = .01$ (see Table B3 in Appendix B for means and standard deviations of this sample). For the minimal criteria sample a Kruskal-Wallis one-way analysis of variance did not indicate any differences in perceived task difficulty between groups, $H(3) = 1.56$, $p = .67$.

NASA-TLX. Sum scores over all six subscales a Kruskal-Wallis one-way analysis of variance did not display any significant differences between groups, $H(3) = 4.75$, $p = .19$. However, when the single subscales were compared between groups, a significant difference was found for the effort subscale of the NASA-TLX $H(3) = 8.83$, $p = .03$. A post-hoc Dunn's test

with Benjamini-Hochberg correction revealed a significant difference between the control groups of the matrix and list product presentation format, $z = 2.76$, $p = .02$ (see Table B4 in Appendix B for means and standard deviations of this sample). The Kruskal-Wallis one-way analyses for the minimal criteria sample could not find any significant difference in effort, $H(3) = 2.15$, $p = .54$, nor for the sum score or any other subscale of the NASA-TLX.

Control Variables

Buying Impulsiveness. The BIS provided a control for any differences between groups in the trait variable buying impulsiveness because this could have affected the dependent variables. A Kruskal-Wallis one-way analysis of variance on the resulting data showed no differences in buying impulsiveness between the groups, $H(3) = 4.54$, $p = .2$. Similarly, a Kruskal-Wallis one-way analysis of variance indicated no difference between groups for the minimal criteria sample, $H(3) = 1.34$, $p = .72$.

Affective State. To control for the influence of affective state on impulsive buying PANAS scores for positive and negative affect were compared between groups. A Kruskal-Wallis one-way analysis of variance on the resulting data registered no differences in positive, $H(3) = 1.55$, $p = .67$, or negative affective state, $H(3) = 0.87$, $p = .83$, between the four groups. Additionally, neither a positive, $H(3) = 1.78$, $p = .62$, nor a negative, $H(3) = 1.26$, $p = .74$, affective state was found to be significantly different between groups for the minimal criteria sample. Compared to standard values of the German version of the PANAS provided by Krohne et al. (1996) the reported positive and negative levels in both samples are within average range.

Budget. To prevent the effect of anchoring on the dependent variables the amount of money participants usually spend on the gifts of friends was collected. However, no significant differences between groups were found for the budget control variable conducting a Kruskal-Wallis one-way analysis, $H(3) = 4.13$, $p = .25$. Equally, no significant difference between groups

was indicated for the minimal criteria sample by a Kruskal-Wallis one-way analysis of variance, $H(3) = 3.04$, $p = .39$.

Motivation. A high motivation level of the participants to conscientiously take part in the study could have affected the dependent variables by compensating the ego-depletion effect. A Kruskal-Wallis one-way analysis could not detect any significant differences between groups, $H(3) = 2.11$, $p = .55$. For the minimal criteria sample another Kruskal-Wallis one-way analysis came to the same conclusion, $H(3) = 3.04$, $p = .39$. However, the single item 5-point Likert scale with a value of 5 representing very high motivation levels revealed quiet high average motivation levels among all N=65 participants ($M = 4.32$, $SD = .5$)(see Table B5 in Appendix B for more information on the control variables).

Dependent Variables

Money. The first dependent variable was the amount of money participants would spend on the ten music titles they were instructed to put in the shopping cart before. Due to ego-depletion it was hypothesized that the amount would be higher for test groups compared to control groups and higher for the matrix than the list product presentation format. However, a Kruskal-Wallis one-way analysis of variance revealed no differences among groups in terms of amount of money they would spend on the music titles, $H(3) = 0.61$, $p = .89$. The comparison of means and standard deviations of this variable for all four groups is illustrated in Figure 3.

For more statistical power an additional Kruskal-Wallis one-way analysis of variance was conducted with the minimal criteria sample but remained non-significant, $H(3) = 4.2$, $p = .24$.

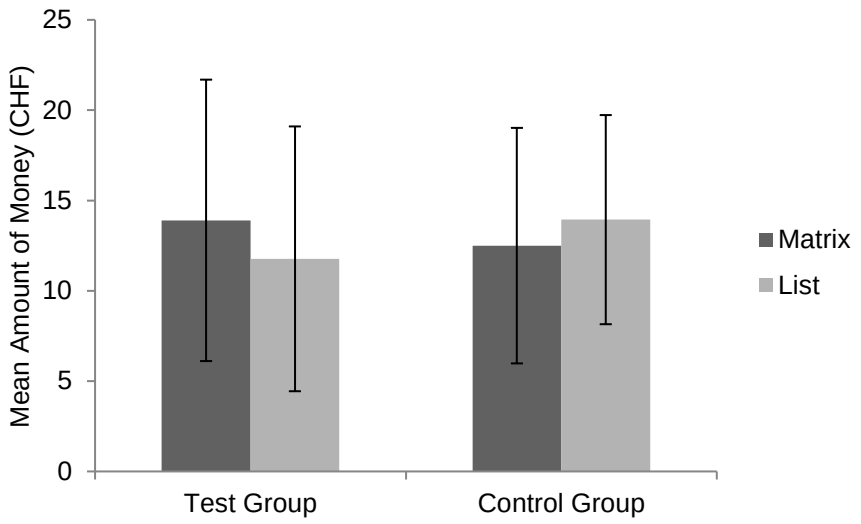

Figure 3. The mean amount of money participants would spend for the music titles on the shopping list did not differ significantly between groups (*N*=65).

Urge. As a second dependent variable the urge to spend more money on the music titles than indicated was measured on a single item scale. The comparison of means and standard deviations of this variable for all four groups is presented in Figure 4. The measurement was expected to be more sensitive to effects of ego-depletion than the first dependent variable. Nevertheless, no significant differences between the four groups could be revealed by conducting a Kruskal-Wallis one-way analysis of variance, $H(3) = 3.19$, $p = .36$. Likewise for the minimal criteria sample, the Kruskal-Wallis one-way analysis of variance showed no significant differences between groups in terms of urge to spend, $H(3) = 5.25$, $p = .15$.

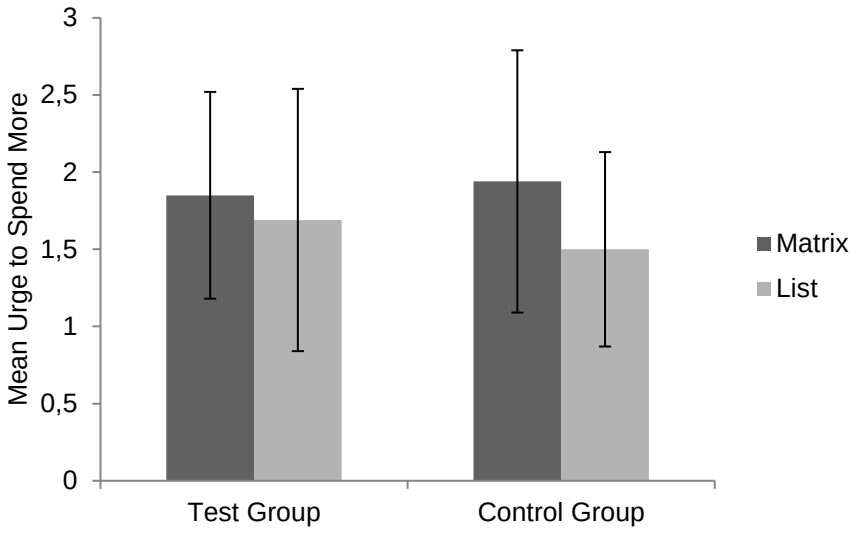

Figure 4. The urge of the participants to spend more money than indicated did not differ significantly between groups (*N*=65). The single item Likert scale ranged from 1 (very small) to 5 (very large).

Task compliance

Analyses using Kruskal-Wallis one-way analyses of variance indicated that groups did not differ in the amount of visited pages in the online shop, number of items and number of correct items added to the shopping cart or time on the task. Although, the Kruskal-Wallis one-way analysis of variance for the number of items in the shopping cart reached significance level at first, $H(3) = 9.06$, $p = .03$. The following post-hoc Dunn's test with Benjamini-Hochberg correction found no significant differences among groups.

For the sample that only fulfilled the minimal criteria (see Table B6 in Appendix B) , the Kruskal-Wallis one-way analysis of variance found no significant differences between groups in terms of task compliance criteria. Particularly, the difference between groups for the number of items in the shopping cart did not reach statistical significance anymore, $H(3) = 0.51$, $p = .92$.

Discussion

Since there is a lack of research, whether product presentation formats differ in terms of depleting willpower during an online shopping task, we designed an online study to shed light on this matter. We hypothesized that the participants of the previously ego-depleted groups (test groups) would spend higher amounts of money (H1a) and perceive a larger urge to spend more money than indicated (H1b) than participants of groups without ego-depletion (control groups). Additionally, the use of the matrix product presentation format was expected to be more ego-depleting than the list product presentation format and therefore result in a higher amount of money participants would spend on the music titles (H2a) and a larger urge of the participants to spend more than indicated (H2b).

Manipulation of Willpower

To be eligible to interpret the effects on the dependent variables the manipulation check had to indicate a successful manipulation. The perceived task difficulty, which served as a manipulation check for ego-depletion by the product presentation format, showed statistically significant differences between the control groups of the list and matrix product presentation format. Additionally, the same groups reported significantly different ratings on the effort subscale of the NASA-TLX. These findings for the control groups are in line with the findings of Schmutz et al. (2010) and Hong et al. (2004a) because both variables were rated higher for the matrix than the list product presentation group.

These differences became non-significant when the minimal criteria sample (N=122) was used for the analysis. This had to be expected however, because the question to assess task difficulty was specifically asked in relation to the task in the online shop and therefore low task compliance was most likely affecting the rating of task difficulty. The same argumentation applies to the effort subscale of the NASA-TLX for the minimal criteria sample. Thus,

interpreting the task difficulty rating based on the minimal criteria sample is problematic and the manipulation check has to be considered as failed for the minimal criteria sample. Therefore, we cannot further interpret the dependent variables for sample with *N*=122 participants.

Interestingly, the significant differences in the sample with *N*=65 participants for the task difficulty and the effort subscale of the NASA-TLX were only found between both control groups and not in comparison with test groups. These differences could be explained by the significant difference in age between the control groups with matrix and list product presentation. However, if this was the case, we would expect other significant age difference between the control and test group of the matrix product presentation format to have a noticeable effect as well, which is not the case.

In conclusion, all the findings of this study have to be interpreted with caution due to the fact that the manipulation check was partly failed either due to low statistical power or low task compliance depending on the sample.

Effects on the Dependent Variables

As discussed above, the sample with the necessary task compliance (*N*=65) possesses only low statistical power. The data was still examined for potential explorative findings for the dependent variables. However, neither the amount of money participants would spend on the music titles nor the urge to spend more than indicated did differ significantly among groups. For explorative purposes we also tested the hypotheses with the minimal criteria sample (*N*=122), since the ego-depleting effect of the previous Simon task could still have affected the dependent variables for the testing group but no significant differences between groups were detected.

A potential reason for this could be significant differences between the groups in terms of control variables such as influence of buying impulsiveness, affective state, budget anchoring effects or different levels of motivations between groups. However, none of the control variables

differed significantly among groups.

In contrast, the reported motivation levels to complete the study conscientiously in all groups were quiet high for all groups and could have had an effect on the amount of money spent on the product and the urge to spend more money than indicated by compensating for potential effects of ego-depletion in the testing groups. However, because groups did not significantly differ in terms of motivation, the substituting effect would have been the same for all groups. Therefore, the significant differences in perceived task difficulty and effort subscales of the NASA-TLX for the control groups would not be expected.

Taking everything into consideration we are not able to conclusively answer our research question if product presentation format influences willpower. The main reason for this was the low task compliance. To gain a better understanding and for potential future studies on the topic we therefore decided to investigate and discuss the task compliance issues.

Task Compliance Issues

The previously mentioned high motivation levels would be expected to have led to higher task compliance. In contrast, we experienced substantial drop-out rates when sticking to our initial criterion that required participants to put at least seven of the ten music titles on the shopping list in the shopping cart during the online shopping task. This reduced the statistical power of our analysis and forced us trying to look into the reasons for such low task compliance.

Due to the fact, that participants reported high motivation levels and that in their honest opinion they think their data is usable for the study we expected a faulty tracking of the participant's actions in the online shop. However, we could not find evidence for the assumption of a faulty tracking system. Additionally, there was a prominent info box on the first page of the experiment that kindly requested participants to disable script blockers and to allow the acceptance of cookies, which should have minimized possible tracking issues on the client side.

It is also possible that participants feared not to be considered for the compensation for the study participation if they did not report high motivational level or if they reported their data should not be used in the study. However, the criteria for compensation were addressed in the informed consent and participants were informed they would be compensated regardless of the outcome of their participation. Moreover, the voucher lottery does not guarantee a compensation for the participants. For this reason participants could not be sure they would receive compensation even if they reported incorrect ratings. A possible influence of social desirability also seems unlikely, because the study was not conducted in groups and moreover in an anonymous online environment. Therefore, the reported levels of motivation may still be reliable, even if they are contradicting to the task compliance measures.

Nevertheless, there is the possibility that participants did not understand the instructions of the task even though we made sure the instructions were reviewed for comprehensibility before the experiment was conducted and provided a graphic to the written instructions. Furthermore, the provided shopping list during the task should have left little room for interpretation what to do because it limited the variance of task completion behavior.

Due to the shopping list the task was a simple search task but maybe participants were confused by the repetitive appearance of the items in the shop and did not realize there were differences in the descriptions of the songs. If this would have been the case, we would expect participants to visit all the product pages in the shop but add items to the shopping cart that were not on the shopping list. However, many participants (n=39) failed to add a single item to the shopping cart and therefore had to be excluded. Additionally, participants did visit mostly all product pages but descriptively more correct (M = 6.02, SD = 4.07) than wrong items (M = 2.54, SD = 3.94) have been added to the shopping cart on average.

Pocheptsova, Amir, Dhar, and Baumeister (2009) reported that ego-depleted participants

were more likely to choose a do-nothing-option in a shopping task if such an option is provided. We did not provide such an option but ego-depletion could have led to the low task compliance nonetheless. While test groups were ego-depleted by the Simon task, control groups might have been ego-depleted as well by the multiple decisions they had to make filling out the questionnaires. For ego-depletion effects to occur willpower capacity does not have to be fully exhausted because people try to conserve the resource as soon as it has been used (Muraven, Shmueli, & Burkley, 2006).

Limitations

Several limitations of this study should be mentioned. Firstly, the possibly biggest limitation of the study is the low task compliance. Consequently, our sample size of participants with high enough task compliance was insufficient to reach enough statistical power to conclusively answer our research questions. This could have been prevented by more pilot testing and a longer data collection time to gather enough participants.

Further limitations include our manipulations checks. There was no manipulation check in the study to specifically check for ego-depletion induced by the Simon task. Based on our pilot study we expected the task to induce ego-depletion and were expecting to see the effect of the induced ego-depletion on the higher values of the dependent variables of the test groups compared to the control groups. However, this was not the case and leaves the question open whether the Simon task was really ego-depleting or not.

The manipulation check of the ego-depletion induced by the product presentation format of the online shop was provided by a single item scale for task difficulty. This form of manipulation check was successfully used by Vohs and Faber (2007). Nevertheless, we think the measurement might be problematic as well, because it might just measures the cognitive load during the task before. It would be better to have a manipulation check that is unrelated to

previously performed task because it would not be necessary for ego-depletion (Baumeister et al., 1998). A standardized method to conduct a manipulation check for ego-depletion would be welcome but does not exist yet (for a good overview see Hagger et al. (2010)). For online studies it is even more difficult to find a suitable manipulation check.

It is also debateable whether the study in form of an online study was the right choice or if a laboratory setting would have been more suitable for our study. It certainly would have allowed more control over the task compliance of the participants. Nevertheless, we still believe creating studies as close as possible to real situations provides useful findings because of their higher external validity. This is especially the case, when the goal of the study is to make predictions for consumer intentions or behavior.

Implications

Due to the low task compliance resulting in a small sample size with limited statistical power providing implication about the research questions proves difficult. However, for online studies it seems crucial to keep track of the task compliance. If low task compliance turns out to be a problem in other online studies as well, especially on the topic of willpower this topic is worth further investigation. The addition of an open text field in online studies is also recommended, because if participants could have provided valid feedback regarding the question why they were struggling with the shopping task.

Directions for Future Studies

Future studies could address the lack of standardized manipulation checks for ego-depletion, especially for online studies. As it was discussed above the manipulation check would have to be distinctive for ego-depletion. Therefore, the measurement should make use of the hangover characteristic of ego-depletion and if it would measure unrelated to the previous task.

Conclusions

This master's thesis had the goal to investigate whether or not product presentation formats differ in terms of depleting willpower during an online shopping task. Specifically, the matrix and list product presentation formats were compared in terms of their ego-depleting effect in a search task that required the comparison of music titles.

In previous research product presentation format has been addressed in terms of cognitive load (Baumeister, 2002) or performance (Hong et al., 2004a) but not willpower. Willpower however, has multiple implications in terms of customer behavior such as resulting in higher amount of money spent or larger urge to spend money (Vohs & Faber, 2007) but has never been investigated in terms of visual manipulation as it is the case in this study.

Due to low task compliance resulting in a sample size with low statistical power the research question could not be answered conclusively. The low task compliance was investigated but did not result in any valid conclusion. Therefore, further studies with higher statistical power are required to answer the initial research question and also to investigate the occurrence of low task compliance in online studies, especially on the topic of willpower.

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Appendix A

Bitte geben Sie an, wie stark die folgenden Aussagen auf Sie zutreffen.

	trifft gar nicht zu	trifft wenig zu	teils-teils	trifft ziemlich zu	trifft völlig zu
Manchmal ist mir danach, Dinge kurz entschlossen zu kaufen.	○	○	○	○	○
"Kauf jetzt, denk später darüber nach" beschreibt mich.	○	○	○	○	○
Ich kaufe oft spontan Dinge.	○	○	○	○	○
"Tu es einfach" beschreibt die Art, wie ich Dinge kaufe.	○	○	○	○	○
Ich plane die meisten meiner Einkäufe sorgfältig.	○	○	○	○	○
Ich kaufe Dinge gemäss meinem momentanen Wohlbefinden.	○	○	○	○	○
Manchmal bin ich etwas leichtsinnig, bei dem was ich kaufe.	○	○	○	○	○
Ich kaufe oft Dinge ohne Nachzudenken.	○	○	○	○	○
"Ich sehe es, ich kaufe es" beschreibt mich.	○	○	○	○	○

Figure A1. The German translation of the Buying Impulsiveness Scale (BIS) originally created in English by Rook and Fisher (1995).

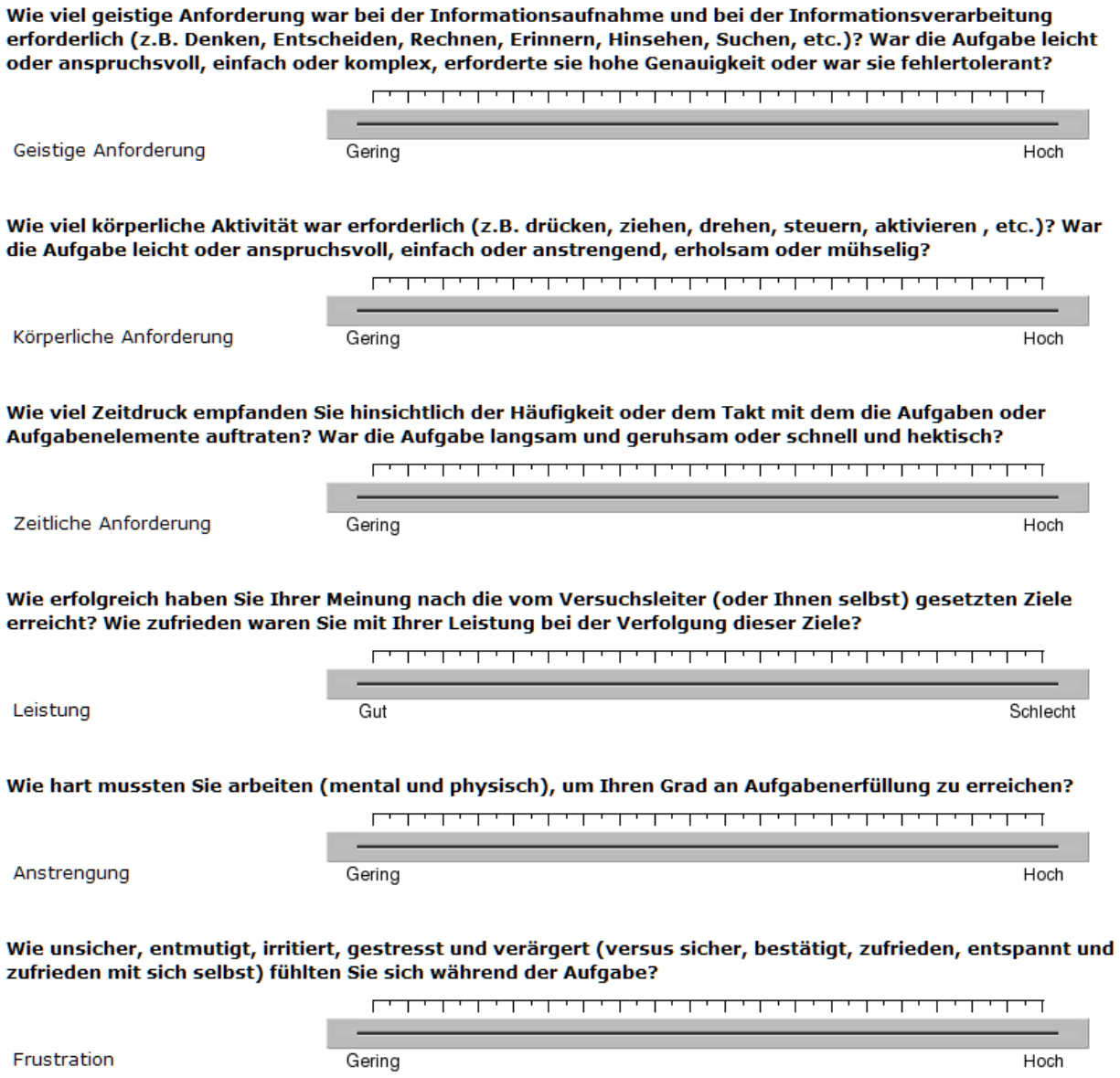

Figure A2. The German version of the NASA Task Load Index (NASA-TLX) by Pfendler (1991) with visual analog scales (VAS).

Appendix B

Table B1

Demographic Variables

	Sample	Age	Gender	
			female	male
Group	*n*	*M (SD)*	*n*	*n*
Matrix				
Test	20	30.45 (10.18)	9	11
Control	16	26 (5.06)	11	5
List				
Test	13	33.85 (12.23)	7	6
Control	16	25.81 (5.46)	12	4
Overall	65	28.89 (9.06)	39	26

Note. Includes all participants with at least 7 correct items in their shopping cart

Table B2

Demographic Variables for the Minimal Criteria Sample

	Sample	Age	Gender	
			female	male
Group	*n*	*M (SD)*	*n*	*n*
Matrix				
Test	35	31.8 (12.33)	21	14
Control	30	28.7 (9.23)	19	11
List				
Test	28	33.14 (13.75)	16	12
Control	29	25.81 (5.46)	21	8
Overall	122	30.51 (11.63)	77	45

Note. All participants had at least 1 item in their shopping cart

Table B3

Perceived Task Difficulty

	Matrix		List	
	Test Group (*n*=20)	Control Group (*n*=16)	Test Group (*n*=13)	Control Group (*n*=16)
Variable	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Task difficulty	2.05 (0.51)	2.13 (0.62)	2.54 (1.05)	1.63 (0.72)

Note. Single item Likert scale ranged from 1 (“very low”) to 5 (“very high”).

Table B4

Perceived Workload

	Matrix		List	
	Test Group (*n*=20)	Control Group (*n*=16)	Test Group (*n*=13)	Control Group (*n*=16)
Variable	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Mental Demand	5.7 (3.21)	6.38 (3.79)	8.23 (4.49)	6.13 (4.03)
Physical Demand	2.65 (1.9)	3.19 (2.29)	3.69 (2.69)	2.69 (2.47)
Temporal Demand	6.3 (4.62)	6.94 (4.02)	6.92 (4.84)	3.32 (3.32)
Task Performance	6.3 (5.27)	5.13 (5.57)	6.54 (4.43)	4.37 (4.37)
Effort	4.85 (3.31)	6.63 (4.51)	8.38 (4.37)	2.74 (2.74)
Frustration Level	6.45 (5.38)	4.75 (3.55)	7.08 (2.96)	5.11 (5.11)
Sum Score	32.25 (14.9)	33 (15.13)	40.85 (16.56)	27.06 (12.94)

Note. Scales of the unweighted NASA-TLX ranged from 1(low) to 20 (high) for each variable.

Table B5

Control Variables

	Sample	BI	Affective State		Budget (CHF)	Motivation
			positive	negative		
Group	*n*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Matrix						
Test	20	23.45 (6.57)	24.5 (7.55)	13.15 (5.02)	69.5 (44.27)	4.4 (0.5)
Control	16	19.5 (5.55)	23.31 (7.87)	12.56 (3.63)	75.31 (64.33)	4.31 (0.48)
List						
Test	13	22.85 (6.12)	22 (5.28)	13.62 (5.69)	51.15 (27.09)	4.38 (0.65)
Control	16	21 (6.8)	24.44 (6.92)	12.63 (2.58)	89.06 (69.50)	4.19 (0.4)
Overall	65	21.75 (6.36)	23.69 (6.99)	12.97 (6.36)	72.08 (54.66)	4.32 (0.5)

Note. Buying Impulsiveness (BI) measured by BIS on a scale from 9 (low) to 45 (high), Affective State was measured by PANAS on a scale from 10 (low) to 50 (high), Motivation single item Likert scale ranged from 1 (low) to 5 (high).

Table B6

Task Compliance Variables for the Minimal Criteria Sample

	Matrix		List	
	Test Group (*n*=35)	Control Group (*n*=30)	Test Group (*n*=28)	Control Group (*n*=29)
Variable	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Visited Pages(n)	9.71 (1.53)	9.67 (1.65)	9 (2.83)	9.38 (1.92)
Items in Cart (n)	8.49 (4.57)	9.17 (4.38)	8.29 (4.55)	8.31 (3.36)
Correct Items (n)	6.25 (4.2)	6.13 (3.85)	5.57 (4.13)	6.07 (4.25)
Time on Task (s)	190.69 (109.02)	167.54 (84.48)	167.93 (85.08)	177.11 (83.92)

Note. If the shopping task was completed correctly, a participant had visited all 10 pages, had 10 items in his cart and all of them were the 10 correct items.

Author's Note

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Non-plagiarism statement

I hereby declare that this thesis is my own work and that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Zurich, May 1, 2016

Marcel Schellenberg