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Biscuits, self-control, chocolate cakes and response conflicts: the influence of trait self-control and temptation strength on the conflict between one's short and long-term goals

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Abstract

This study investigated in what way one's level of trait self-control, as well as the strength of a temptation influences the magnitude and process of a response conflict. To gain insight into this, a digital mouse tracker categorization task was used, in which participants categorized foods of varying temptation strengths. Participants were students at Utrecht University. Prior to starting the task, they filled in the Brief Self-Control Scale to assess their level of trait self-control. Contrary to expectations, results from the categorization task indicated the magnitude of a response conflict appeared to be lower in participants with a higher level of trait self-control. An interaction was found between temptation strength and the level of trait self-control, influencing this magnitude: a higher magnitude was observed for people lower in self-control than for people higher in self-control. The size difference in the magnitude of a response conflict between people high and low self-control was bigger when pictures of weakly tempting food were shown than for when pictures of highly tempting food were shown. For the process of a response conflict, no main effect of the level of trait self-control was found. There was no interaction between the temptation strength of level of trait self-control for the process of a response conflict. Based on these results, suggestions for future research are given.

Keywords: temptation strength, trait self-control, categorization task, response conflict

Many have encountered these kinds of situations; you are two weeks into your diet, when a tempting piece of chocolate crosses your path. Or you are working on your dissertation, when your roommate asks you to watch *Game of Thrones* with them. Illustrated above are examples of so-called temptation-goal conflicts, involving two opposing motives. On the one hand, there is a motive pressing towards a smaller, proximal reward. On the other hand, there is a motive that presses towards a larger, more abstract and remote reward. It is a clash between the need for immediate satisfaction and the pursuit of a larger, long-term goal. (e.g. staying slim or receiving good grades). Therefore, this dilemma has also been referred to as a dual-motive conflict (Fujita, 2011) or a response conflict (Gillebaart, Schneider & De Ridder, 2015). The conflict entails that only one of the two motives or goals can be satisfied. In order to successfully resolve the conflict, meaning to resist the temptation, one must employ self-control and act consistently with the motive that presses towards the long-term goal. Thus, self-control is "the process of advancing distal motives over concrete, proximal motives where the two motives directly conflict" (Fujita, 2011, p. 353).

People possessing high levels of self-control are able to successfully resist temptations, which may lead to a more successful life. For example, several studies have shown students who score high on trait self-control get better grades than other students and have fewer impulse control problems, including binge eating and alcohol abuse, than people low in self-control (Wolfe & Johnson 1995; Tangney, Baumeister & Boone, 2004). There is also evidence that people with high self-control manage their money better than others; they save more and spend less (Romal & Kaplan, 1995). High self-control is also shown to positively correlate with healthier eating- and weight control behaviors (De Ridder, Lensvelt-Mulders, Finkenauer, Stok & Baumeister, 2012). For example, people high in trait self-control consumed fewer crisps in a taste-and-rate test than people low in self-control (Friese & Hofmann, 2009). In short, being able to successfully employ self-control is a highly useful

capacity, which yields a range of benefits. Yet, to date, little research has been conducted on the mechanisms behind successfully employing self-control, for traditional research tended to focus on self-control failure; explaining why and in what situations people are likely to be unsuccessful employing self-control (e.g., Baumeister, Heatherton & Tice, 1994; Muraven & Baumeister, 2000).

More recent studies, however, are focused on how and why self-control can be used successfully (e.g., Adriaanse, Kroese, Gillebaart & De Ridder, 2014; Galla & Duckworth, 2015 and Gillebaart & De Ridder, 2015). The current study will build upon this, and will investigate why people with high trait self-control are able to resist temptations better than people with low self-control.

Before delving into further detail, the theoretical background on self-control will be discussed. A traditional viewpoint in self-control literature is that temptations automatically trigger hedonic impulsive behavior and inhibit the conflicting long-term goal (e.g., Stroebe, Mensink, Aarts, Schut, & Kruglanski, 2008; Strack, Werth, & Deutsch, 2006). For instance, if self-control is not exerted, seeing a plate of tasty French fries immediately results in eating them, jeopardizing one's health goals. Hofmann, Friese and Strack (2009) explain this by using a dual-system theory, proposing the temptation-goal conflict as a conflict between our so-called impulsive and reflective systems. The impulsive system is, as its name implies, responsible for generating impulsive behavior. Impulses emerge from the activation of associative clusters in long-term memory by perceived or imagined stimulus input. For instance, after repeated exposure to chocolate, our brain develops an associative cluster that links the concept of chocolate to the positive affect, and the behavior that led to this affect (i.e. chocolate tastes nice, and one can acquire this pleasant experience by putting the chocolate in one's mouth). In contrast to the impulsive system, the reflective system is responsible for higher order mental operations including deliberate judgments, forming

strategic action plans for goal pursuit and inhibiting impulsive behavior. In a self-control dilemma, the behavioral results of the two systems are incompatible; one of the systems has to beat the other (Hofmann et al., 2009). To resist impulses generated by the impulsive system, the reflective system will need to spring into action. It may also prompt people to exert self-control, which depends on limited resources of cognitive capacity (Muraven & Baumeister, 2000). Therefore, self-control has been compared to a muscle or a battery, which strength decreases after previous effort, but replenishes after a period of rest (Muraven & Baumeister, 2000).[1] Following this line of reasoning, people are able to resist temptations, yet at the cost of being unable to control themselves all the time: after just having successfully resisted a delicious piece of cheesecake, it is much harder to resist buying that beautiful but overly expensive pair of shoes. This cognitively taxing way of coping with temptations, however, may be somewhat simplistic; if this were the only way to deal with temptations we would be exhausted by the end of our day. Therefore, Fujita (2011) suggests a different model in which people are not always condemned to wait passively until a temptation arises before they can start resisting their impulses. Rather, people play a more active role by anticipating and implementing strategies to reduce chances of self-regulation failure. By doing so, they prevent dealing with temptations from becoming too cognitively taxing. An example of this would be Odysseus, who expected the calls of the Sirens to be tempting beforehand, and consequentially had himself tied to the mast of his ship in order to resist the calls.

Along with the differing model, Fujita suggests a broader definition of self-control: self-control is the general process in which people advance abstract, distal motives over concrete, proximal motives when confronted with a temptation (Fujita, 2011). In this definition, effortful inhibition is regarded as one of the many means by which people employ

[1] Note: more recent studies, however, indicate have reported small to zero effect sizes of this notion and even imply that studies finding evidence for the muscle metaphor may be influenced by publication bias (see for example Carter & McCullough, 2013; Lurquin et al., 2016)

self-control, rather than the only way in which people control themselves. Thereby, Fujita (2011) rightfully moves the focus away from failure in temptation-goal conflicts by recognizing people are not always dancing to the whims of their impulses. Indeed, people are often able to resist temptations without relying on effortful inhibition, according to a meta-analysis conducted by De Ridder and colleagues (2012) examining the effects of self-control. Contrary to the authors' expectations, results showed that the beneficial effects of employing self-control were larger for automatic behaviors that are normally performed without effort or conscious attention, such as habits, than for behaviors performed under effortful control. The beneficial effect of self-control on behaviors that required a lot of conscious intention or deliberation, such as solving puzzles or making decisions, was almost 2.5 times smaller than on addictive or habitual behaviors. This relatively large difference disconfirms the view of self-control as being a solely effortful, inhibiting mechanism. It also suggests that people with high in self-control are especially effective at forming and breaking habits. Thus, although most theories about self-control have focused on the specific act of resisting temptation in a particular setting, De Ridder and colleagues (2012) argue self-control may generally operate more by forming and breaking habits. Possibly, self-control may be most effective by establishing and maintaining stable patterns of behavior, rather than by performing single acts of self-denial.

Given the results of the meta-analysis, could it be that people high in self-control are able to establish effective habits or routines, rather than being more successful in resisting single temptations that require effortful inhibition of impulses? Hoffman and colleagues (2012) present evidence for this suggestion, showing people with high self-control reported weaker desires, less motivational conflict and lower levels of resistance toward various desires. These results also showed that people high in self-control encountered fewer desires that others rated as problematic. Adriaanse and colleagues (2014) investigated whether habits

like eating fruit or unhealthy snacks, could be a mediator for self-control. Indeed, results confirmed what Hofmann and colleagues (2012) suggested; people high in trait self-control were more likely to have weaker unhealthy snacking habits, and subsequently consumed less unhealthy snacks. Together, these findings suggest that people with high trait self-control are able to deal with problematic temptations more successfully than people with low trait self-control, implying self-control may be related to the forming of adaptive routines or habits, rather than the ability to control oneself in specific situations.

It may be that people high in self-control do experience response conflict: they recognize the temptation a piece of chocolate cake poses, but have better or smarter strategies for dealing with this conflict. Studies on response conflicts show that people with high trait self-control do recognize the clash between immediate satisfaction and their health goals when confronted with tempting foods that are not in line with their health goal, just like people with lower levels of self-control do. Yet they do not experience this conflict to the same extent: they seem to experience this conflict as being less intense. Moreover, people with high self-control report less conflict on healthy foods such as vegetables. This may be a consequence of the healthy habits that people they have adopted (Gillebaart & De Ridder, 2015). Hofmann and colleagues (2012) support this idea, showing that people with high trait self-control experienced weaker desires for temptations, resulting in lower reported levels of response conflict.

However, not all temptations are equal. Imaginably, a biscuit poses less of a temptation than a slice of chocolate cake. Therefore, temptation strength should be taken into account. Indeed, research on counteractive control (Kroese, Evers & De Ridder, 2009; Trope & Fishbach, 2000), poses that temptation strength matters in dealing with a response conflict. In certain situations, temptations may actually facilitate, rather than inhibit, self-control: when confronted with a tempting cue, the long-term goal that is threatened by the temptation at

hand is activated. This threat subsequently activates the goal-oriented behavior. In other words, the response conflict experienced when confronted with a temptation can function as an “alarm bell” for people to activate their long-term goals, since they are threatened by a temptation. But in order to use this alarm bell, a response conflict needs to be identified first. Thus, counteractive control may take place in the early stages of the response conflict, when people are identifying the temptation and the conflict it causes (Myrseth, Fishbach & Trope, 2009). Following the notion of the “alarm bell”, Counteractive Control Theory (CCT) proposes strong temptations (e.g. a salted caramel cheesecake) produce more active self-regulation process than weak ones (e.g. a biscuit), because stronger temptations form a larger threat to long-term goals and may be perceived as having higher anticipated costs. Thus, if strong temptations elicit strong goal-pursuing responses, weak temptations will generate low self-control efforts. Kroese, Evers and De Ridder (2011) support this notion: weak temptations, as compared to strong temptations, had an inhibitory effect on self-regulation. Weak temptations, thus, yield less favorable results for successful self-regulation, because people may be better in dealing with strong than with weak temptations: it may be easier to say ‘no’ to a fresh piece of apple pie to go along with the coffee than to a biscuit, though the biscuit may still negatively affect one’s health.

Referring back to the study by Gillebaart and De Ridder (2015); results demonstrate that higher trait self-control is associated with lower explicitly experienced levels of response conflict. Additionally, people high in self-control overcame the response conflict faster than people with lower self-control (Gillebaart et al., 2015). Yet, temptation strength influences the time in which people in general solve a response conflict. Since people in general may be better able to deal with strong temptations than with weak temptations (Kroese, Evers & De Ridder, 2011), weak temptations may result in a response conflict that takes longer to solve, regardless of one’s level of self-control. Yet, the influence of temptation strength may be

stronger for people with lower self-control, for they experience higher levels of response conflict and dealing with temptations is more trying for them. Thus, it may well be that the difference in the time in which a response conflict is solved between strong and weak temptations is bigger for people with lower trait self-control than for people with higher trait self-control.

Current Study

The current study will delve deeper into this interplay between temptation strength and trait self-control. This is important, for insight in this mechanism could help people to improve their level of self-control. Participants' level of trait self-control will be assessed using the Brief Self-Control Scale (Tangney et al., 2004). Additionally, using a mouse tracker categorization task in which participants will categorize foods of varying temptation strength, reaction time as well as variables identifying the process and magnitude of the response conflict will be measured.

Differences in the regulation of response conflict between people high and low in trait self-control can lay either in the magnitude of the response conflict, or in how the process of the response conflict evolves from emergence to resolution. The magnitude of the response conflict is important because a larger response conflict will be harder to solve (Bargh, Chaiken, Govender & Pratto, 1992; MacLeod, 1991), which requires more self-control and reduces the chance of successfully solving the response conflict. In addition to the magnitude of the response conflict, trait self-control can also be associated with differences in the response conflict process (the temporal unfolding of the response conflict). For example, the finding of Hofmann and colleagues (2012) suggests that people with high trait self-control self-report less desire for temptations, which may reflect these people are able to down-regulate the response conflict more effectively, rather than experiencing a smaller response conflict from the beginning. Moreover, Gillebaart and colleagues (2015) found that higher

trait self-control is associated with lower experienced levels of response conflict, which indicates the magnitude of the response conflict influences how fast are able to recognize a response conflict. People high in self-control were indeed shown to overcome the response conflict faster than people with lower self-control (Gillebaart et al., 2015). In this study, therefore, it is expected the results of Gillebaart and colleagues (2015) will be replicated; people with higher trait self-control will resolve response conflicts faster than people with lower trait self-control. In addition, based on CCT, it is expected that response conflicts with a strong temptation will be solved faster than response conflicts with a weak temptation.

The aforementioned expectations have all been studied before, yet the exact role of temptation strength remains unclear. Therefore, the most important expectation is that the difference in response conflict identification (the time in which a response conflict is solved) between strong and weak temptations is smaller for people with higher trait self-control than for people with lower trait self-control.

Knowledge of the possible role of temptation strength when employing self-control, and the interplay between these two factors, will be greatly useful in further accommodating and tailoring future interventions to people struggling with lower levels of self-control.

Methods

Participants & Design. In total, 133 participants took part in this study. 98 participants were recruited through the shared lab of Utrecht University, where students could participate in small experiments to earn course credits or a small monetary reward. 34 of the participants were recruited outside of the lab, and participated in the study from home.

The mean age of the participants was 21.92 years (*SD* = 2.84 years), ranging from 17 to 34. Of the participants, 97 were female and 35 were male. One participant did not disclose their gender. Participants were informed about the purpose of the study and consented to participate in the study before starting. The experiment had a mixed design, with two independent and two dependent variables. The first independent variable was temptation strength (within subject, categorical). The second independent variable was trait self-control (between subject, continuous). The first dependent variable was time of maximum deviation (continuous). The second dependent variable was reaction time (continuous). Both were collected while participants were making decisions about tempting food pictures using the mouse tracker categorization task, programmed in Javascript.

Participants were shown pictures of packaged and unpackaged food. In a pilot study, these pictures of packaged and unpackaged food were classified as respectively weakly tempting (e.g. a wrapped bag of popcorn) or highly tempting (e. g. two donuts on a plate, ready to be eaten). The pictures were shown in the bottom middle of the screen, and were to be categorized as ‘positive’ by clicking the upper right corner of the screen or ‘negative’ by clicking the upper left corner of the screen.

Materials.

Categorization Task Pictures of weakly and strongly tempting food items were shown in a categorization task, which records participants' mouse movements (trajectories) traveling towards two response options (negative and positive) on the screen. The categorization task consisted of 3 blocks. The task started with a practice block, after which the first critical block started. During the critical blocks, 8 pictures containing packaged and unpackaged food were shown. Throughout these blocks, pictures could be categorized as 'positive' or 'negative' by clicking respectively the upper right or left corner of the screen. The orientation of response options was reversed in a second critical block. All critical blocks included either weakly tempting food or strongly tempting food only. After each block, the task continued with a filler block to disguise the actual measurements. During the filler blocks, frontal pictures of faces were shown which could be categorized as 'male' or 'female'. After the first three blocks, participants were instructed to fill out the simple math task to diminish carry-over effects between the weak temptation condition and strong temptation condition. The order of the critical blocks was counterbalanced across participants. The digital categorization was used to measure several variables.

'Maximum deviation' refers to the largest deviation between the actual mouse trajectory and the ideal trajectory: a straight line from the target stimulus to the respective category. 'Average deviation' refers to the geometric area under the curve made by the mouse between the actual and the ideal trajectory. Together, these variables illustrate a temporal, spatial attraction to the alternative answer option when this attraction is at its peak. As in the study by Gillebaart and colleagues (2015), the measures average deviation and average deviation can be regarded as proxies for the magnitude of the response conflict.

To assess the response conflict process, the 'time of maximum deviation' has been extracted. The time of maximum deviation is measured both absolute and relative to the

overall reaction time. The absolute time of maximum deviation refers to the point in time when the actual trajectory deviates maximally from the ideal trajectory. The relative time of maximum deviation entails the same as the absolute time of maximum deviation, yet is measures relative to the overall reaction time. The time of maximum deviation is interpreted as the time on which the response conflict is at its peak. Lastly, 'reaction time', refers to the overall time needed to categorize a stimulus.

Brief Self-Control Scale Trait self-control was measured using the Brief Self-Control Scale (Tangney et al., 2004). This scale consists of 13 statements. For each statement, participants had to indicate to what extend they reflected how they typically are. An example of such a statement is *'I do certain things that are bad for me, if they are fun'*. Rating the statements was done on a 5-point Likert scale, ranging from 1 (not at all applicable) to 5 (very much applicable). Of the items, 9 items were reverse coded. After recoding and reversing, high scores on the scale reflected a high level of trait self-control. The Brief Self-Control Scale is a reliable scale, with a Cronbach's Alpha of .93.

Big Five Personality Test To disguise the actual measurements taken in this study**,** a shortened version of the Big Five personality traits test (Goldberg, 1992) was used as a cover story. This scale consists of 25 items. For each statement, participants had to indicate to what extend they agreed with it. An example of such a statement is *'I am someone who tends to be lazy'*. Rating the statements was done on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The results of this test were not used in the actual analysis.

Math task This simple math task consisted out of 75 items, like 12 + 9 = . This task also functioned as a filler task congruent with the cover story and was not used in later analysis.

Procedure. Participants were escorted to a private cubicle where they were asked to start on the digital categorization task. Participants recruited outside of the lab could open the

task on their pc or laptop at home, and complete it there. Halfway through the categorization task they were instructed to digitally fill out a 75-item math task. Participants could do this at their own pace. After finishing the simple math task they continued to the second part of the digital categorization task. Directly after finishing the second part of the categorization task, they were redirected to an online questionnaire, which included the Brief Self-Control Scale (Tangney et al., 2004), the Big Five personality traits (Goldberg, 1992), and demographical questions (including age, sex and questions regarding the importance of healthy eating and whether participants were on a diet). After the experiment, participants were asked to fill in their email addresses in order to receive a debriefing. They were reimbursed with either course credit or €2.

Results

Mean trait self-control was 3.09 (*SD* = 0.59). All analyses were controlled for participants being on a diet, which proved to be of no influence. A logarithmic transformation was conducted on the outcome measures average deviation and maximum deviation, as well as the reaction time, because their values were not normally distributed. This was not the case for the time of maximum deviation (both absolute and relative).

Linear regression analyses were performed to determine whether trait self-control predicted average deviation, maximum deviation, the relative as well as the absolute time of maximum deviation and the reaction time respectively. During these regression analyses, no distinction was made yet between weakly tempting and highly tempting food items. The first linear regression analysis showed trait self-control significantly predicted the overall average deviation (β = -.18, t = -2.12 p = 0.04, 95% CI [-.13, -.004], meaning that higher trait self-control was associated with a smaller geometric area between the actual mouse trajectory and the ideal trajectory. Furthermore, a significant effect of trait self-control on the overall maximum deviation has been observed (β = -.18, t = -2.13, p = 0.04, 95% CI [-.13, .01], meaning higher trait self-control predicted a smaller deviation between the actual trajectory of the mouse and the ideal trajectory. However, trait self-control did not predict the overall absolute time of maximum deviation (β = .14, t = 1.64, p = 0.10, 95% CI [-2.34, 25.36]. In contrast, the relative time of maximum deviation was significantly predicted by trait self-control (β = .20, t = 2.28, p = 0.02, 95% CI [.01, .05], in which a higher self-control predicted a later relative time of maximum deviation. Gillebaart and colleagues (2015) found the opposite: higher self-control predicted an earlier absolute time of maximum deviation. The current results on the time of maximum deviation are therefore unexpected.

Trait self-control did not predict reaction time (β = -.06, t = -0.63, p = 0.53, 95% CI [-.04, .02], meaning the level of self-control did not influence the time in which participants categorised a temptation as 'negative' or 'positive'. See Table 1 for an overview.

Table 1

Regression results of trait self-control on average deviation, maximum deviation, time of maximum deviation and reaction time

Dependent variable	B	SE	R^2
Average deviation	-0.07 *	0.03	0.03
Maximum deviation	-0.07 *	0.03	0.03
Time of maximum deviation			
Absolute	11.46	6.97	0.02
Relative	0.03 *	0.01	0.04
Reaction time	-0.01	0.02	0.00

Note. n = 132. Independent variable = trait self-control. * $p < 0.01$

These results are partly in line with the hypothesis about replicating Gillebaart and colleagues (2015). Their results showed trait self-control did not predict average deviation or maximum deviation, while this study shows the opposite. Moreover, Gillebaart and colleagues (2015) found trait self-control significantly predicted reaction time and time of maximum deviation. The current results do not replicate this. In the study by Gillebaart and colleagues (2015), trait self-control predicted the absolute time of maximum deviation. In the current study, self-control predicted the relative time of maximum deviation instead.

Paired sample *t*-tests were performed to investigate whether there was an effect of temptation strength on average deviation, maximum deviation, the relative as well as the absolute time of maximum deviation and the reaction time. The tests showed there was no difference between respectively weak and strong temptations in the measures average deviation (M_{weak} = 1.50, SD = 0.23), (M_{strong} = 1.49, SD = 0.25); t(131) = 0.64, p = 0.53, maximum deviation (M = 1.84, SD = 0.23), (M = 1.83, SD = 0.25); t(131) = 0.81, p = 0.42 and

the absolute time of maximum deviation (*M* = 260.61, *SD* = 53.63), (*M* = 258.30, *SD* = 53.46); *t*(131) = 0.56, *p* = 0.58, as well as the relative time of maximum deviation (*M* = 0.46, *SD* = 0.01, (*M* = 0.45, *SD* = 0.09); *t*(131) = 0.73, *p* = 0.47.This indicates there was no influence of temptation strength on the time in which a response conflict was identified. There was, however, a significant difference in overall reaction time between weak (*M* = 3.03, *SD* = 0.12) and strong temptations (*M* = 3.01, *SD* = 0.12); *t*(131) = -3.24, *p* = 0.00; participants completed the trials faster when temptations were strong, and were slower when temptations were weak. The results on reaction time are in line with the hypothesis and CCT. However, contrary to the expectation, no effect for temptation strength on any of the other outcome variables was observed.

To test the hypothesis on the interaction effect between the strength of temptation and participants' level of trait self-control, repeated measure analyses were conducted, with high or low tempting food as a within-subjects factor and higher or lower self-control as a between-subjects factor. The between subjects factor was determined by dividing the trait self-control measure in a higher and a lower self-control group by means of a median split. Participants with a trait self-control score higher than 3.12 were in the high self-control group. Participants with a trait self-control score lower or equal to 3.12 were regarded as being low in self-control. While there was no main effect to be observed for temptation strength on the average deviation, there was an interaction effect between temptation strength and participants' level of self-control *F*(1,129) = 5.11, *p* = 0.03). For people lower in self-control, higher values of average deviation were observed than for people higher in self-control. Yet the difference between these values of average deviation was bigger when pictures of weakly tempting food were shown than for when pictures of strongly tempting food were shown. For the maximum deviation, no main effect of the level of self-control has been observed either. There was, however, a marginally significant interaction *F*(1,129) = 3.23, *p* = 0.08). As with

the interaction effect found on average deviation, higher values of maximum deviation were observed for people lower in self-control than for people higher in self-control. The difference between these values of maximum deviation was bigger when pictures of weakly tempting food were shown than for when pictures of highly tempting food were shown. Figure 1 and 2 show a visual representation of the interaction effects on respectively average deviation and maximum deviation.

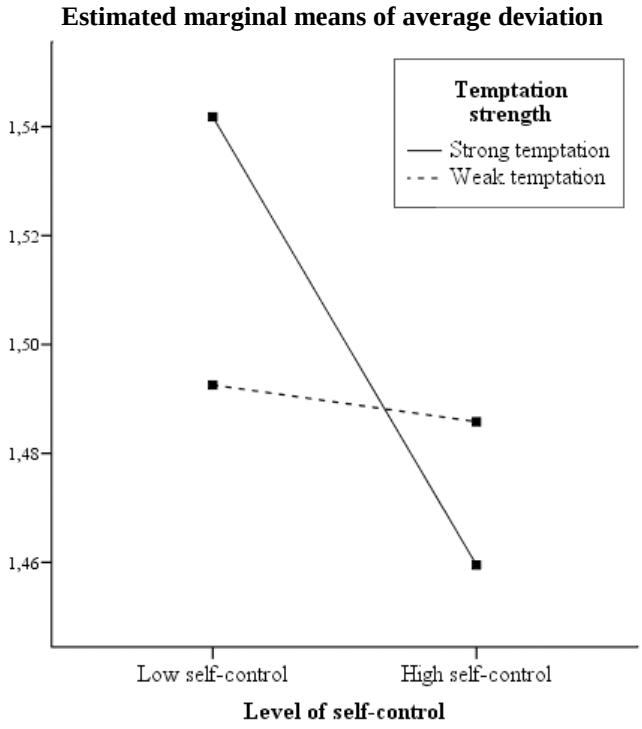

Figure 1. The interaction effect on average deviation

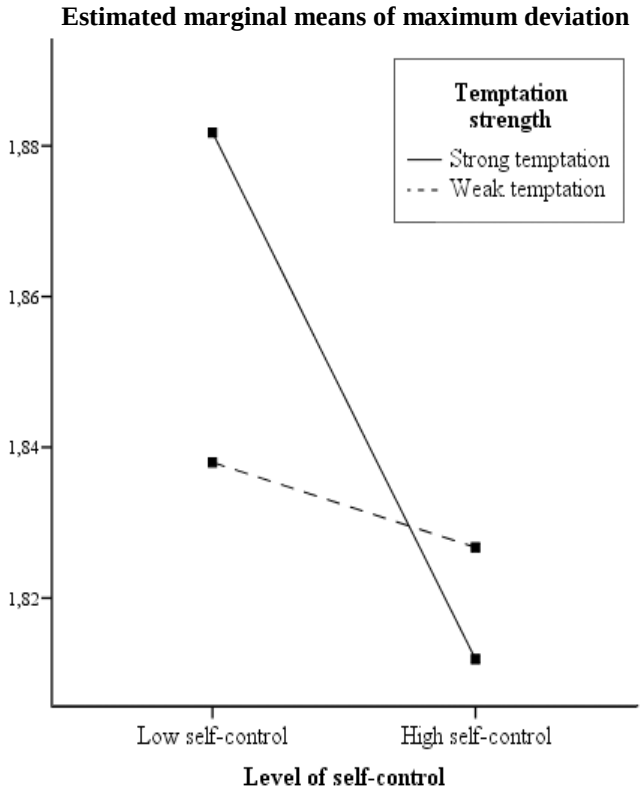

Figure 2. The interaction effect on maximum deviation

For the absolute time of maximum deviation, there was no main effect of temptation strength or an interaction effect between temptation strength and participants' level of self-control ($F(1,130) = 0.06$, $p = .80$). For the relative time of maximum deviation, there was an aforementioned main effect, yet no interaction effect: $F(1,130) = 0.54$, $p = 0.46$. For reaction time, a main effect of temptation strength could be observed $F(1,129) = 10.25$, $p = 0.00$). but no interaction between temptation strength and trait self-control for reaction time $F(1,130) = 0.27$, $p = 0.60$). These results are only partly in line with the expectations, as an interplay between participants' level of self-control and the strength of the temptation was only found for average deviation and maximum deviation. This is unexpected, for an interaction effect was expected for the time of maximum deviation and reaction time instead.

The (marginally) significant interaction effects on the average deviation and the maximum deviation will be explored further. This was done by performing an additional repeated measure analysis to determine whether the interaction effects found, could be pulled

by the group of people with a higher or a lower self-control. However, dividing a continuous variable like trait self-control into groups diminishes variance, which perhaps contributed to the fact that the results of these analyses were not significant: the repeated measure analysis showed that for both the scores on average deviation and maximum deviation, it did not matter whether people were high or low in trait self-control. Neither did the temptation strength have any influence. Furthermore, the effects of the variables trait self-control and temptation strength on average deviation and maximum deviation did not strengthen or weaken each other. Because the results are non-significant, they can only be regarded as additional descriptive information, as shown in Table 2 and 3.

Table 2

Descriptive values of repeated measure analysis for average deviation after a median split

Group	SS	df	MS	F	p	Partial R^2
Low trait self-control	0.02	1	0.08	1.26	0.07	0.05
Error	1.18	65	0.02			
High trait self-control	0.08	1	0.08	3.39	0.27	0.02
Error	1.53	65	0.02			

Note. $n = 132$. * $p < 0.01$

Table 3

Descriptive values of repeated measure analysis for maximum deviation after a median split

Group	SS	df	MS	F	p	Partial R^2
Low trait self-control	0.06	1	0.01	0.38	0.07	0.01
Error	1.44	65	0.02			
High trait self-control	0.01	1	0.06	2.85	0.37	0.04
Error	1.26	65	0.02			

Note. $n = 132$. * $p < 0.01$

Discussion

The goal of this study was to examine the effect of one's level of self-control and temptation strength on the way people deal with a conflict, the need for immediate satisfaction and the pursuit of a larger, long-term goal. It was expected that people with higher trait self-control would resolve these response conflicts faster than people with lower trait self-control. In addition, it was expected that response conflicts in the categorization task would be solved faster when people were confronted with a strong temptation than with a weak temptation. With these two hypotheses, it was expected the results of the study by Gillebaart and colleagues (2015) would be replicated. The most important expectation of this study, however, stated that the difference in the time in which a response conflict is solved between strong and weak temptations would be smaller for people with higher trait self-control than for people with a lower level of trait self-control.

Results showed trait self-control predicted the overall average deviation and maximum deviation. Higher trait self-control was associated with a smaller magnitude of the response conflict: people with higher levels of trait self-control had less difficulty overcoming the response conflict than people with lower self-control. However, trait self-control did not predict reaction time (the time in which participants categorised a temptation as 'negative' or 'positive'). Therefore, the expectation that people with a higher level of trait self-control overcome response conflicts faster than people with lower self-control cannot be supported.

Trait self-control did not predict the absolute time of maximum deviation. In contrast, the relative time of maximum deviation was predicted by trait self-control. A higher level of self-control was associated with a later time of maximum deviation: people high in trait self-control experienced maximum conflict at a point later in time than people lower in trait self-control.

Results of this study imply that people higher in trait self-control experience smaller response conflicts than people lower in self-control. Apparently, people with higher trait self-control experience a response conflict as being less intense to begin with. This could be the reason why they are able to withstand temptations more successfully than people with lower levels of self-control. This is consistent with the initial findings from self-report diary studies by Hofmann, Baumeister, Förster and Vohs (2012). These studies demonstrated that the magnitude of desire for temptation is generally lower for people with high trait self-control, which implies people high in self-control experience a smaller response conflict. Haynes, Kemps and Moffitt (2016) reveal that the lower desire experienced by individuals with higher trait self-control found by Hofmann and colleagues (2012) are maintained even after controlling for aspects of the food environment and motivation that may influence eating behavior. In sum, this study indicates that, contrary to what Gillebaart and colleagues (2015) found, trait self-control does influence the magnitude of a response conflict. The strength of a temptation highly influences this magnitude for people lower in trait self-control. For these people, their ability to resist a temptation also depends on whether they face a biscuit or a slice of chocolate cake.

Regarding the process of a response conflict, Gillebaart and colleagues (2015) found trait self-control significantly predicted reaction time and time of maximum deviation. Current results only show an effect of self-control on the relative time of maximum deviation, yet interestingly, this effect was opposite in direction of the effect found by Gillebaart and colleagues (2015). The absence of an effect on the absolute time of maximum deviation may be explained by the fact that the relative time of maximum deviation more accurately depicts the point in time when the actual trajectory deviates maximally from the ideal trajectory and therefore is better able to determine a possible effect.

Current results indicated there was no influence of temptation strength on the time in which a response conflict is identified. However, temptation strength did influence the reaction time, confirming the second hypothesis of this study. Participants completed the trials faster when temptations were strong and were slower when temptations were weak. These results reflect what CCT poses: when confronted with a tempting cue, the response conflict that arises functions as an "alarm bell" for people to activate their long-term goals, since they are threatened by a temptation. This bell was 'louder' with strong temptations than with weak temptations, causing people to solve trials faster when confronted with a stronger tempting cue. Yet in order to use the alarm bell, a response conflict needs to be identified first. Therefore, Myrseth and colleagues (2009) suggest counteractive control may take place especially in the early stages of the response conflict, where people are identifying the temptation and the conflict it causes. Remarkably, however, no effect of temptation strength on the outcome variables reflecting the time of response conflict identification, or any of the other outcome variables was observed.

The current study additionally investigated differences in the time in which a response conflict is solved between strong and weak temptations for people with higher trait self-control than for people with a lower level of trait self-control. Results showed an interaction effect of temptation strength and self-control on average deviation and maximum deviation. Specifically, for people with a higher level of trait self-control the response conflict magnitude was smaller than for people with lower self-control, regardless of temptation strength. For people with lower trait self-control, however, temptation strength was shown to influence this magnitude. They had less difficulty in overcoming the response conflict with weakly tempting food but when images of highly tempting food were shown, their response conflict magnitude was much bigger. Interestingly, people with a higher trait self-control showed higher levels of response conflict magnitude when confronted with weak temptations

than when confronted with strong temptations. For the absolute and relative time of maximum deviation, as well as the reaction time, there was no interaction effect between temptation strength and participants' level of trait self-control. This interplay between self-control and temptation strength was found for the magnitude of a response conflict, but not for the response conflict process. Therefore, the expectation stating the difference in the time in which a response conflict is solved between strong and weak temptations would be smaller for people with higher trait self-control than for people with a lower level of trait self-control can be confirmed only for the magnitude of a response conflict. While CCT poses that strong temptations would yield better self-control outcomes compared to weak temptations (Kroese et al., 2011), the current results indicate this may not be true for all people. The interaction effect of trait self-control and temptation strength on the magnitude of a response conflict demonstrates strong temptations yield better self-control results for people with high self-control, like the studies by Kroese and colleagues (2011) predicted, but not for people with lower trait self-control. For these people, strong temptations may be particularly dangerous for self-regulation processes.

This study has several strengths. First and foremost, the interplay between temptation strength and trait self-control has never been studied before. It is important to investigate this interaction, for only focusing on one of the two factors may not be sufficient to expose the underlying mechanisms of how people deal with a response conflict. Results of this study indicated there indeed is an interplay between temptation strength and self-control, at least on the magnitude of a response conflict. This indicates temptation strength and self-control are important key factors that should be included in future studies.

Another strong asset of this study is its focus on trait self-control rather than state-dependent self-control. State self-control varies across situations and time: people's capacity and motivation to exert self-control is susceptible to situational influences (Baumeister,

Bratslavsky, Muraven & Tice, 1998; Muraven & Baumeister, 2000). Because of this susceptibility, it is only used in certain situations. Therefore, state self-control yields less predictive power than trait self-control. In contrast, trait self-control is regarded as being a personality trait and is relatively stable across situations and over time within one individual (Gillebaart et al., 2015). It has been shown to have a substantial predictive power on all kinds of life outcomes, such as health, well-being and academic and career success (De Ridder et al., 2014; Tangney et al., 2004). Thus, because the current study focuses on trait self-control, it allows for more ecologically valid conclusions that are more likely to hold outside of laboratory settings.

Despite these strong points, some limitations may be identified as well. It should be noted that temptation strength as a factor is difficult to standardize. In the current study, temptation strength is operationalized relatively (images of unwrapped food items were regarded to be stronger than images of wrapped food items) because no uniform scale of temptation strength exists. Geyskens, DeWitte, Pandalaere and Warlop (2008), however, state that 'real' food items available for consumption (so-called 'actionable temptations') are strong, whereas pictures of food items (so-called 'inactionable temptations') can be considered weak. Yet, results of both the pilot and the current study clearly showed differential effects of weak and strong temptations within the images. Secondly, although studying trait self-control allows for more ecologically valid conclusions than studying state-dependent self-control, it is not clear whether the results found may carry over for actual eating behavior.

There are several avenues of future research that may be worth pursuing. Given the theory on actionable and inactionable temptations (Geyskens et al., 2008) it may be wise to test the tempting properties of food images again, in a study more extensive than a pilot. For there may be factors that have not been foreseen during the pilot, such as the influence of the

packaging on people's perception of the product inside. Indeed, research on food packaging shows that aesthetics play a big role in consumer choices. When food is packaged, product characteristics have to be inferred from the package. The impression that a package needs to create in the mind of the consumer is affected by package characteristics like size, shape, colour, images and text (Van der Laan, De Ridder, Viergever & Smeets, 2012). Aesthetic packages increase the attractiveness and therefore, the likelihood of the food to be bought (Silayoi & Speece, 2004, 2005). This can be studied using self-report methods, or more sophisticated options like the neuro-imaging used by Van der Laan and colleagues (2012). It is interesting to investigate whether certain brain regions become more active using pictures of strongly tempting or weakly tempting food.

Because the current study demonstrates one's level of trait self-control influences the magnitude of a response conflict, future research could strengthen this evidence by using other means than a categorization task. An approach/avoidance task, wherein participants move a joystick to either approach or avoid pictures of weakly or strongly tempting food, for example. Building upon this, it could be valuable to investigate whether the magnitude hypothesis holds when using real food. Because using a categorization task in this setting would not make much sense, self-report could be used to gain insight in the amount of conflict experienced when being confronted with strong or weakly tempting food items. In previous occasions, self-report regarding the magnitude hypothesis has proven to be effective (see for example Priester & Petty, 1996).

Lastly, another direction worth pursuing may be to look for alternative ways of measuring one's level of trait self-control. It may be important to distinguish between the level of self-control that comes forth out of self-reported measures of self-control and the level of self-control that may be inferred from more implicit measures. Duckworth and Kern (2011) recognize the Brief Self-Control Scale (Tangney et al., 2004) used in this study to be

the best self-report measure in terms of consistency and predicting properties. Yet, they state self-control is best assessed using multiple methods. It may thus be worthwhile in future studies to both assess self-reported and more objectively measured self-control, and distinguish between the two outcomes.

To conclude, although the current study yields some unexpected results regarding the process of overcoming a response conflict between two opposing goals, there is certainly some evidence that the difference between people with higher levels of trait self-control and people lower in trait self-control may lie in the magnitude of such a response conflict. Oscar Wildes' famous quote "I can resist anything except temptation" could, following the results of this study, use some nuance. For the key to successfully resisting a temptation may lie in the strength of such a temptation. Altogether, the mechanism behind successfully employing self-control has not been cracked yet, but this study has without a doubt contributed to unraveling some of its secrets.

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