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Implicit versus explicit measures of self-concept of self-control and their differential predictive power for spontaneous trait-relevant behaviors

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ABSTRACT

Background and objectives: Low trait self-control constitutes a core criterion in various psychiatric disorders. Personality traits such as low self-control are mostly indexed by self-report measures. However, several theorists emphasized the importance of differentiating between explicit and implicit indices of personality traits, Therefore, the present study examined the unique predictive validity of an implicit measure of trait self-control for spontaneous dysfunctional behavior.
Methods: As a measure of implicit trait self-control, we used an irrelevant feature task: a speeded reaction time task comprising a task-relevant stimulus feature (i.e., capital vs. lower case letter type) and a task-irrelevant feature (high vs. low self-control word type). The irrelevant feature had to be ignored, while participants ($n = 34$) responded to the relevant stimulus feature. However, their response was either congruent or incongruent with the irrelevant stimulus feature, resulting in facilitated or deteriorated task performance. As indicators of trait-related spontaneous dysfunctional behavior, we included indices of frustration tolerance and the preference for short-term reward over meeting long-term goals. We also included two explicit measures of trait self-control: a self-report questionnaire and an explicit self-relevance rating of the implicit task stimuli.
Results: Specifically the implicit measure of trait self-control showed predictive validity for the target self-control behaviors.
Limitations: The predictive validity of implicit measures of personality traits requires further study in larger, non-student samples.
Conclusions: As predicted, the implicit measure of trait self-control showed superior predictive power for spontaneous trait-related behavior. This finding points to the relevance of complementing the routinely used self-report measures with implicit measures of trait self-control.

1. Introduction

Self-control can be broadly defined as the regulation of thoughts, emotions, impulses, task performances, and attentional processes (Vohs & Baumeister, 2004). Low self-control ability is the culprit of many problems in daily life. It is manifested in spontaneous, usually troublesome behavior that is often experienced as difficult to prevent and hard to be stopped. Low self-control constitutes a core criterion in various psychiatric disorders on both axis I (e.g., conduct disorder, addictive disorders) and axis II (e.g., borderline and anti-social personality disorder) of the DSM-IV-TR (APA, 2004).

We can differentiate between self-control ability (i.e., the actual ability to regulate one's cognitive, emotional, and behavioral responses) and the mental representation of one's self-control. Self-control theory (see Muraven, Pogarsky, & Shmueli, 2006) and cognitive schema theory (e.g., Young, Klosko, & Weishaar, 2003) emphasize the role of self-associations of self-control (i.e., perceiving the self as lacking control over cognitions, emotion, and behavior). These self-concepts of self-control develop early in life as a result of the interplay between a child's temperament (i.e., disinhibition), and ineffective parenting. According to the schema theory of Young et al. (2003) toxic interactions during childhood and adolescence are processed into so-called 'early maladaptive schemas', which are thought to form a blueprint for subsequent experiences, leading to self-perpetuating cycles of thoughts, emotions, and behavior. These ingrained patterns form the base of

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personality traits, which are present in every human being, but become more rigid and extreme in more symptomatic individuals.

To assess the self-concept of self-control and other so-called 'early maladaptive schemas', Young and Brown (1994) developed the Young Schema Questionnaire (YSQ-2), which has been tested worldwide for its psychometric properties, with favorable results (e.g., Rijkeboer & van den Bergh, 2006). Patients with elevated scores on the Insufficient Self Control (ISC) scale perceive themselves as having an ongoing difficulty to exercise sufficient self-control and frustration tolerance to achieve personal goals, or to restrain the excessive expression of emotions and impulses. They report that they prefer short-term gratification over meeting long-term goals and do not seem to learn sufficiently from the negative consequences of their behavior (Young et al., 2003).

The mental representation of self-concept of self-control is usually derived from self-report. The use of self-reports entails several assumptions about the assessment of personality. Most important it implies that a) schemas are readily known by each individual and hence reliably and validly measured through self-reports, and b) these self-reports have meaningful relationships with actual behavior. Introspection, however, may be difficult when it concerns underlying emotions and cognitions that are part of self-defeating patterns developed early in life (Ganellen, 2007). Furthermore, self-reports are sensitive to self-deception tendencies, social desirable answering tendencies, and self-presentation strategies (i.e., presenting yourself in a favorable light). Hence, self-reports may not be the best way to index personality traits as self-control.

Self-reports might also suffer from serious limitations in the prediction of spontaneous dysfunctional behavior as shown by people who suffer from low self-control. In a recent meta-analysis only small to medium effects of trait self-control, measured by self-reports, on actual behavior were found (De Ridder, Lensvelt-Mulders, Finkenauer, Stol, & Baumeister, 2012). Dual process theories propose that perception, thinking, and behavior are functions of two different systems of information processing (Schnabel & Asendorpf, 2010). More spontaneous behavior would be controlled by an implicit mode of processing, characterized by relatively non-intentional, reflexive processes. More reasoned behavior, on the other hand, would be determined by an explicit mode of processing, characterized by controlled, reflective information processing (e.g., Fazio & Towles-Schwenn, 1999; Strack & Deutsch, 2004). If one has enough resources available for cognitive control and if one is motivated to do so, behavior is mostly determined by reflective processes. However, if one has to act fast or if cognitive resources are limited by competing cognitive demands, more reflexive, impulsive processes will take over. So, according to dual process theories, the spontaneous, maladaptive behavior that is specific to low self-control, is related to a reflexive mode of processing, and might be best predicted by implicit performance measures of this trait. Controlled behavior, on the other hand, might be best predicted by explicit self-report measures of personality (but see for habit behavior (e.g., smoking) De Ridder et al., 2012).

Germane to this, a series of studies showed that implicit measures of various personality traits (including neuroticism, agreeableness, anxiousness, and shyness) displayed differential or cumulative validity in the prediction of relatively spontaneous trait-related behavior, while self-report measures proved to be superior in the prediction of more controlled trait-relevant behavior (Asendorpf, Banse, & Mücke, 2002; Back, Schmukle, & Egloff, 2009; Egloff & Schmukle, 2002; Schnabel, Banse, & Asendorpf, 2006; Steffens & Schulze König, 2006). None of these studies, however, included measures for trait self-control. The aim of the present study was therefore to assess the unique predictive validity of an implicit measure of the self-concept of self-control for relatively spontaneous dysfunctional behavior.

2. Present study

As a measure of implicit self-concept of the personality trait self-control, we used an irrelevant feature task that has been successfully employed in previous research to determine obsessive-compulsive self- and other associations (Weertman, Arntz, de Jong, & Rinck, 2008). In an irrelevant feature paradigm, there is an irrelevant stimulus feature that has to be ignored (in this case word content) and a relevant stimulus feature that determines the participant's response requirement (in this case upper or lower letter case) (cf. De Houwer, 1998). Participants respond according to the relevant feature (e.g., say "Yes" to uppercase letters and "No" to lowercase letters). Importantly, there is a dimensional overlap between the task irrelevant stimulus feature and the relevant response. That is, the response is either congruent or incongruent with the word content of the task irrelevant stimulus feature. As an example, the response "Yes" to words denoting low self-control would be schema-congruent for people who score low on self-control. Although participants are instructed to respond to the task-relevant feature only, they will also automatically retrieve task-irrelevant semantic stimulus information. In its turn, such automatic (non-intentional) processing of stimulus content will facilitate or deteriorate task performance depending on whether there is a match or a mismatch between stimulus content and the required response.

In the present task, each trial is preceded by a prime consisting of the phrase "I am" or "Others are" (see Weertman et al., 2008). When prime phrase and target word are compatible for the person (e.g., "I am" followed by "chaotic" or "Others are" followed by "orderly" for a person low in self-control), responses will be relatively fast and/or responses will be relatively slow when prime phrase and target word are incompatible, independent of the specific response (Yes or No).

We specifically considered the differential predictive validity of the implicit measure on several indices designed to capture the spontaneous behavioral equivalent of self-control. To index frustration tolerance, participants were presented with an unsolvable puzzle task (Tangram) and a nerve spiral task. While Tangram is taxing cognitive control resources, the nerve spiral task is more demanding on motor control resources. Two trained observers rated participant's filmed reactions shown in these two predetermined situations as an index of spontaneous aspects of behavior that cannot be easily controlled voluntarily. As a third behavioral task, participants performed an Iowa Gambling Task (IGT; Bechara, Damasio, Damasio & Anderson, 1994), indexing the preference for short-term rewards over meeting long-term goals. In the Iowa Gambling Task we instructed the participants to try to gain as much money as possible by drawing selections from a choice of four decks, while starting with a fictitious loan. The decisions to choose from the decks become motivated by reward and punishment schedules inherent in the task (Bechara, Damasio, Damasio, & Lee, 1999 for more details). We calculated internal consistency in the current sample (see Table 1). As an explicit measure, we included the 15-item self-control subscale of the Young Schema Questionnaire (YSQ-2; Young & Brown, 1994). We denote this subscale the ISC (Insufficient Self-Control) scale. Patients with elevated scores on the ISC scale report difficulty or refusal to exercise sufficient self-control and frustration tolerance to achieve personal goals, or to restrain the excessive expression of emotions and impulses. Short-term gratification is preferred over meeting long-term goals and they do not seem to learn sufficiently from the negative consequences of their behavior (Young et al., 2003). Studies suggest significant relationships between the ISC scale and self-report measures of trait anger and anger expression (Waller et al., 2003), trait aggressiveness (Tremblay & Dozois, 2009), and impulsivity (Rijkeboer, 2005). As an additional index of explicit self-concept, we also included

Table 1
Summary statistics for the main variables ($n = 34$).

Variable	*M*	*SD*	Reliability
ISC scale	2.50	.73	.88a
Self-rating:			
Stimulus schema-congruent (chaotic)	3.63	.81	.50a
Stimulus schema-incongruent (control)	4.72	.76	.55a
Implicit self-control measure	2.23	11.36	−.27d
SDS	8.35	2.84	.58a
Tangram:			
Composite score irritation	2.32	2.70	.49b
Composite score giving up	1.76	1.94	.60b
Nerve spiral:			
Composite score	7.06	7.90	.86b
Iowa gambling task:			
Mean net score	119.53	99.73	.97c
Mean RT for disadvantageous decks (in ms)	887.57	484.77	.69c
Mean RT for advantageous decks (in ms)	522.21	235.56	.73c

Note. ISC = Insufficient Self-Control and Self-Discipline scale; SDS = Marlowe–Crowne Social Desirability Scale. a = Cronbach's alpha in the current sample; b = Spearman's rho correlations between scores of two raters; *c* = Spearman's rho between even and uneven trials, d = Pearson correlation between the first half and the second half of the test scores.

participants' self-relevance ratings of the implicit task stimuli (i.e., consisting of words indicative of [low] self-control).

All in all, the present study was designed to assess the unique predictive validity of an implicit measure of the trait self-control for spontaneous dysfunctional behavior. We hypothesized a superior predictive validity of implicit trait self-control (as indexed by the irrelevant feature task) compared to explicit trait self-control (as indexed by the ISC scale and the stimulus self-ratings) for spontaneous dysfunctional behavior.

3. Methods

3.1. Participants

Thirty-five non-selected psychology students (21 males) participated in the study. The students were recruited with flyers. The mean age of the sample was 21.94 (SD: 2.25). Ethical approval for this study was granted by the ethical board of the University of Groningen. All participants were individually tested and completed an informed consent. They received 10 euro for participation.

4. Measurements

4.1. Implicit task

As the implicit measure, we used the variant of the semantic Simon task developed by Weertman et al. (2008, experiment 3). Each trial was preceded by the prime "I am" or "Others are", which was shown for 1500 ms. After a fixation cross of 500 ms, the stimulus was displayed. We asked the participants to respond as fast as possible. Response latencies were measured using a microphone that was connected to a voice key. A research assistant marked errors by means of an interface button. We included twelve stimulus words: six self-control congruent words (e.g., controlled, calm), and six self-control incongruent words (e.g., chaotic, impulsive, see the appendix for the complete list of stimuli). We matched the schema-congruent and schema-incongruent words on mean number of letters. Each word was presented for eight times with the prime "I am" and eight times with the prime "Others are", resulting in a total of 192 trials. The stimulus words were presented in a fixed random order, whereas the primes were presented in a blocked and counterbalanced order (i.e., in one condition the block 'I am" was followed by the block "Others are", and in the second condition this order was reversed). Every word was displayed equally often in uppercase letters and lowercase letters. The relationship between relevant feature (i.e., upper or lower case) and relevant response ("Yes" or "No") was counterbalanced across participants. Thus, we instructed half of the participants to answer with "Yes" to uppercase letters and with "No" to lowercase letters, whereas the other half of the participants got the reverse instructions. Participants performed eight practice trials with unrelated stimulus words.

4.2. Explicit rating and questionnaires

As an explicit measure of trait self-control, we included the 15-item Insufficient Self-Control subscale of the Young Schema Questionnaire (YSQ-2; Young & Brown, 2003). Examples of items are "I have a very difficult time sacrificing immediate gratification to achieve a long-range goal", "If I can't reach a goal, I become easily frustrated and give up", and "It often happens that, once I start to feel angry, I just can't control it". Scores could range from 1 (completely untrue) to 6 (describes me perfectly), with high scores indicating low self-control. The Dutch version of the scale was found to have excellent reliability, given the estimates for internal consistency ($\alpha = .90$) and temporal stability ($r = .83$), and good construct and discriminative validity (Rijkeboer & Van den Bergh, 2006).

We also included stimulus ratings of the words used in the implicit task. Participants rated the words on a scale from 1 (not typical for me at all) to 7 (very typical for me). A facilitation score was calculated as schema-congruent ratings ("I am chaotic") minus schema-incongruent ratings ("I am orderly"). High, positive scores indicate self-ratings of low self-control. Finally, to index social desirable answering strategies, we included a short 17-item form of the Marlowe–Crowne Social Desirability Scale (SDS; Crowne & Marlowe, 1960). Subjects indicate whether they agree or disagree with each item (e.g., "I always admit my mistakes openly and face the potential negative consequences"). High scores indicate social desirable answering. The scale possesses good internal reliability, convergent, and discriminant validity (Stöber, 2001).

4.3. Behavioral measures

We employed three behavior measures. First, participants completed a computerized version of the Iowa Gambling Task (Bechara et al., 1994). In the task participants either win or lose points by selecting one of four symbols in each trial. The instructions make clear that some symbols are more beneficial than others. Indeed, there are two high-gain symbols, each yielding 200 points per gain. Yet, in the long-run they produce a net-loss ("disadvantageous deck"). There are also two low-gain symbols worth 150 points, which in the long run produce a net-gain ("advantageous deck"). Symbols that share the same gain differ in magnitude and frequency of loss, so that one symbol is associated with frequent but small losses, whereas the other provides infrequent large losses. To the participant, the duration of the task is not known in advance. In our version, the participants played the game for 300 trials with instructions to reach the highest score possible. We additionally instructed the participants that might they reach a score of 3000, they would be rewarded with 5 euros. We calculated the mean net score by subtracting disadvantageous selections from advantageous selections. A net score above zero is indicative of advantageous selections, whereas a net score below zero implies disadvantageous selections and is indicative of dysfunctional behavior. Additionally, we calculated the mean decision time for advantageous and disadvantageous selections (cf., Cella, Dymond, Cooper, & Turnbull, 2007).

Secondly, a puzzle task known as Tangram was employed. Participants were asked to assemble the 7 pieces of the puzzle into figures that were portrayed −in a smaller scale- on paper. After practicing two fairly easy figures, the critical test item consisted of a figure that was impossible to complete with the 7 pieces provided, but this was unknown to the participant. Again, the participant was promised 5 euros if they performed the task correctly within the time limit, which was set at 10 min. The participant's behavior during the Tangram puzzle task was recorded by a hidden camera. Two independent raters scored the recordings on frequencies of verbal irritation (e.g., cursing, "Arrrg", "This is frustrating"), nonverbal irritation (e.g., slam with fist on table, finger drum, groan and moan), verbal indices of giving up (e.g., "I want to quit", "Do I have to do this any longer?"), and nonverbal indices of giving up (e.g., pushing away the puzzle, sit back and hesitate to start again). Based on an exploratory factor analysis, we calculated two tangram composite scores (i.e., a Giving Up score and an Irritation score).[1] Higher scores are indicative of dysfunctional behavior.

The nerve spiral task was the third task, and was constructed as such, that it was very difficult to complete. The apparatus consisted of an iron spiral and participants had to move a small ring around the spiral up until the end. If they touched the spiral, a loud beep was heard and a light bulb flashed, indicating that they had to start all over again. There was one practice trial. The time limit for the task was set at 10 min. We promised the participants 5 euros if they performed the task correctly (i.e., reached the end of the spiral once within the time limit). The participant's behavior during the nerve spiral task was also recorded and rated by two independent raters for the same indices. Based on an exploratory factor analysis, we calculated one nerve spiral composite score.[2] A higher score is indicative of dysfunctional behavior.

4.4. Procedure

To keep participants ignorant of the true aim of this study, they were told in advance that it concerned a study of individual differences in problem solving, and that participation involved a) completing questionnaires on personality traits, and problem solving in daily life, and b) performing various tasks, in order to determine problem solving skills and decision strategies. Participants first completed the implicit task, and subsequently rated the task stimuli and filled in the YSQ (including the ISC), and the social desirability scale. Subsequently, they completed the behavior tasks in fixed order (IGT, Tangram, nerve spiral). Finally, we paid and debriefed the participants. Participants were told during this debriefing that they were filmed and that the actual study aim was to determine self-control. At this point, we asked them to consent in the use of the film material for further analysis.

5. Results

5.1. Implicit task

Due to technical errors, we did not record data for one participant on the implicit task. This person was not included. Reaction times (RTs) on trials where an incorrect response was given, were discarded (1.3% of the trials). Mean RTs (SD) on schema-congruent trials in the 'I am' block (e.g., "I am chaotic") were 486.70 (59.13) and in the 'Others are' ("Others are orderly") block 497.07 (60.47). On schema-incongruent trials these were 489.83 (61.51) in the 'I am' block and 498.41 (61.40) in the 'Others are' block. Following the approach of Weertman et al. (2008), we calculated a priming facilitation score as schema-incongruent trials (prime "I am" followed by self-control words like "orderly" and prime "Others are" followed by words like "chaotic") minus schema-congruent trials (prime "I am" followed by low self-control words like "chaotic" and prime "Others are" followed by words like "orderly). Positive facilitation scores thus indicate an association between the self with low self-control and/or others with high self-control. For the implicit measure, reliabilities were calculated for each of the four trial types (i.e., combinations of either prime "I am" or "Others are" and schema congruent and schema incongruent stimulus words). First, we divided all trials into two subsets by using the first half of the scores and the second half separately for each trial type. We then calculated the mean scores for each trial type. We estimated the reliability for each trial type using the Spearman−Brown split-half coefficient. The reliability estimates varied between .93 and .97 for the different trial types. For the facilitation score we calculated the correlation (Pearson) between the facilitation score as based on the first half of the test scores and the second half of the test scores. The reliability for the facilitation score failed to reach significance ($r = -.27$).

5.2. Association between priming measure, explicit measures, social desirability, and behavioral measures

In Table 1, summary statistics for the main variables can be found, including additional reliability estimates. Associations between the implicit index of self-control, explicit measures, and the behavioral measures are depicted in Table 2. Unless stated otherwise, the reported correlation coefficients are Pearson correlations.

While the explicit measures (ISC and stimulus self-ratings) were correlated significantly, neither of these scores was significantly related to the implicit self-control measure. Furthermore, there was no meaningful correlation between the implicit index of self-control and the social desirability measure, whereas social desirability showed a significant correlation with the ISC and the stimulus self-rating score. That is, participants with high scores on self-reported self-control also scored high on social desirability.

Table 2
Correlations ISC subscale, stimulus self-ratings, implicit measure of self-control, social desirability scale, and behavioral measures ($n = 34$).

	ISC scale	Stimulus self-rating	Implicit self-control
ISC scale	–	.57**	−.08
Stimulus self-rating	.57**	–	.08
SDS	−.36*	−.57***	.14
Behavioral measures:			
Iowa Gambling Task:			
Mean net score	−.06	−.02	−.13
Mean decision time for disadvantageous decks	−.07	−.17	.08
Mean decision time for advantageous decks	−.17	−.20	.36*
Tangram:			
Composite score irritation	.17	.28	.10
Composite score giving up	−.29	−.07	.02
Nerve spiral			
Composite score	−.07	.08	.35*

ISC = Insufficient Self-control scale; SDS = Marlowe−Crowne social desirability scale, *$p < .05$, **$p < .01$, ***$p < .001$.

[1] Spearman's rho for the tangram indicators were .51** for verbal and nonverbal irritation and .34* for verbal and nonverbal giving up. Correlations between the irritation and giving up indicators were not significant. *$p < .05$, **$p < .01$.

[2] Spearman's rho for the nerve spiral indicators were .37* for verbal and nonverbal irritation, .62** for verbal and nonverbal giving up, .29 for verbal irritation and verbal giving up, .43* for verbal irritation and nonverbal giving up, .51** for nonverbal irritation and verbal giving up, and .42** for nonverbal irritation and nonverbal giving up. *$p < .05$, **$p < .01$.

As the composite scores for the nerve spiral and Tangram puzzle task were not normally distributed (evidenced by a significant Kolmogorov–Smirnov statistic), we report Spearman rank order for these variables. The nerve spiral composite score was significantly related with the implicit measure of self-control, but not with the ISC score or the stimulus self-rating score. The Tangram composite score did not correlate significantly with any of the explicit or implicit self-control measures.

As the decision time variables for the Iowa Gambling Task were not normally distributed, the reported estimate of correlation for these variables is Spearman's rho. The positive mean net score indicates that subjects chose more advantageous than disadvantageous decks. The mean number of choices for good decks across participants was 209.76 (SD = 49.87) out of 300, with a remaining mean of 90.24 (SD = 49.87) for bad choices. There were no significant correlations with the implicit or explicit indices of self-control. A significant correlation was found, though, between the implicit index of self-control and the mean decision time for advantageous decks, indicating that participants who are characterized by low self-control are slower in deciding to choose a good deck. No significant correlation was found between the implicit index and the mean decision time for disadvantageous decks.

6. Discussion

We set out to evaluate the unique predictive validity of an implicit measure for spontaneous behavioral indicators for the personality trait self-control. The major results can be summarized as follows: while the two explicit self-control measures (Insufficient Self Control scale and stimulus self-ratings) did not correlate significantly with the indices of spontaneous self-control behaviors, the implicit self-control measure correlated significantly with two (out of six) of the behavioral measures. Specifically, participants with self-associations of low self-control (as indexed by the implicit task) scored high on verbal and nonverbal irritation and (non) verbal indicators of giving up on the nerve spiral task. These participants also proved slower in deciding to choose an advantageous deck (i.e., a deck that provides a relatively low gain on the short term but a positive gain in the long run) on the Iowa Gambling Task. Finally, whereas the explicit self-control measures were both correlated with the social desirability measure, no such association was found for the implicit self-control measure.

In line with the starting point that self-report measures are not the best way to index personality traits such as self-control, none of the explicit measures showed predictive value for the target self-control behaviors. Interestingly, the implicit performance measure did show predictive validity for (part of) the index behaviors. These results are in line with the dual process theories and underline the relevance of differentiating between more automatic and more deliberate indices of self-attitudes (Gawronski & Bodenhausen, 2009).

The present data substantiate the validity of the implicit measure, although we did not find associations between the implicit measure of self-control and all of the self-control behavioral measures. With regard to the Iowa Gambling Task, we only found a relationship between the implicit index of self-control and the mean decision time for advantageous selections. This indicates that individuals with a relatively poor trait self-control need more time to choose good decks. For the mean net score or the mean decision time for disadvantageous selections a similar predictive relationship was absent. This may have been due to the sample included in this study, which consisted of students performing relatively well, as was also indicated by the high rate of good deck choices (i.e., with a mean of 210 out of 300). As a result of relatively few bad deck choices, the decision time for disadvantageous selections probably was a less distinctive index compared to the decision time index for good deck choices. For patients with related disorders (e.g., impulse control disorders), the proportion of bad deck choices might well be elevated, and consequently the association between the self-concept of self-control and the behavioral effects (as indexed by net score and decision time for disadvantageous decks) might also be more clearly visible.

We also expected a significant correlation with the Tangram composite score measure but did not find one. One explanation might be that the Tangram task lacked sufficient sensitivity which was also suggested by the lower variance in task performance. Additionally, the Tangram scores proved not as reliable (determined by Spearman's rho correlations between scores of two raters) compared to the nerve spiral task. However, according to the 'self-control depletion' perspective (Muraven et al., 2006), students are likely to have more cognitive control resources (taxed in the Tangram task), than motor control resources (taxed in the nerve spiral task), so the latter resources might have been depleted at an earlier stage than the former ones, leading to stronger frustration reactions, and more variance in the nerve spiral task. This might have led to the difference in sensitivity of both tasks.

Both explicit trait self-control measures were negatively correlated with the social desirability scale, that is, participants who were inclined to give socially desirable answers, scored more positively on the self-report measures of self-control. The finding that both explicit measures showed substantial correlations with the social desirability scale is consistent with the view that the self-report indices of trait self-control are susceptible to demand and self-presentation strategies. Clearly this underlines further the importance of implicit measures for indexing trait self-control and may also explain why for none of the behavioral tasks the explicit measures showed predictive value.

One could argue that the current task by itself demands self-control resources, possibly influencing the task results. We want to emphasize that poor cognitive control is associated with a stronger influence of automatic processes on behavior, in other words, relatively less impact of the reflective system and relatively more of the associative, impulsive system. While poor cognitive control thus may *strengthen* the effect of the automatic system on behavior (faster RTs on congruent trials, e.g., I am chaotic, combined with slow RTs on incongruent trials, e.g., I am ordered), such poor cognitive control cannot *cause* this pattern of responding (i.e., if there is no specific self-association, there is no automatic association to express from the automatic impulsive system). Participants with high self-control are expected to be relatively well able to respond according to task instructions and are therefore expected not to show a facilitation effect (i.e., no faster responding on congruent trials and slower on incongruent trials). In future studies, models separating multiple processes will be of value in delineating the distinctive processes involved in implicit cognition paradigms (Conrey, Sherman, Gawronsky, Hugenberg, & Groom, 2005). In the current study, we chose not to use this type of analysis because, given the very low overall error rates, such analysis would not result in meaningful results. However, in future studies, especially in clinical samples, higher error rates are to be expected.

Most important, the present data substantiate the unique predictive validity of an implicit measure as a predictor of behavior indices of frustration tolerance and short-term reward sensitivity. Importantly, it should be noted that the sample size in the current sample was relatively small. Replications in larger samples would thus be necessary as results obtained with larger samples are more likely to be replicable than those obtained with smaller ones (Asendorpf et al., 2013). In these larger samples, the possible influence of method factors should also be determined. Moreover, replications across different paradigms would be welcome. As a first measure of personality self-concept, we included an irrelevant feature paradigm in this study. Compared to the often used Implicit

Association Task (IAT; Greenwald, McGhee, & Schwartz, 1998), this measure has been argued to be less sensitive to non-associative factors. Because in the present paradigm the content of the self-descriptors represents a task-irrelevant feature, the task seems less sensitive to recoding strategies and thus to non-associative factors such as Figure-Ground asymmetries (e.g., De Houwer, 2002, 2003). However, it remains to be seen whether implicit trait measures can be used as a reliable indicator of individual differences. Germane to this, it should be acknowledged that the internal consistency of the implicit index of trait self-control was well below the norm that would be acceptable for a self-report measure. However, it is not uncommon to find excellent predictive value in combination with nonsignificant internal consistency in this type of paradigms (for example see Huijding & de Jong, 2005; Weertman et al., 2008). Relevant in this regard, Spruyt, De Houwer & Hermans, (2009) questioned whether internal consistency is an appropriate index of the reliability of an irrelevant feature paradigm, especially when predicting spontaneous behavior. It seems reasonable to expect that participants are generally well able to ignore stimulus content and to just respond on the basis of the task relevant stimulus feature (e.g., upper vs. lower case letter), whereas only on some trials people may be distracted by the stimulus content giving rise to the critical bottom up interference effects. Thus, this bias will possibly not be consistent across relevant trials given its spontaneous nature. If indeed the critical interference effects only occur on a limited number of trials, internal consistency will typically be low. Of course it still remains critical to establish whether the present implicit index of trait self-control does show satisfactory reliability, for example in terms of test re-test consistency.

An important next step would be to see whether implicit self-control associations are a vulnerability factor in the onset or maintenance of self-control related clinical disorders. While at the moment, a direct translation to a therapeutic context is not possible, the current study suggests that the inclusion of implicit measures of underlying pathological beliefs may prove to be a valuable addition to self-report measures both in the diagnostic and the therapeutical stage. The results of this study indicate that implicit trait measures are less influenced by self-presentation strategies or social desirable answering compared to self-report scales. Moreover, the knowledge gathered by an implicit measure tapping more directly into self-attitudes of which the patient may consciously be unaware can help therapists and patients alike to become more aware of their underlying associations.

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Appendix

English (and Dutch) stimulus words used as a function of word type.

Schema congruent	Schema incongruent
Chaotic (chaotisch)	Orderly (geordend)
Impulsive (impulsief)	Steady, stable, in control (beheerst)
Indolent, (laks)	Hardworking (hardwerkend)
Addicted (verslaafd)	Moderate (gematigd)
Impatient (ongeduldig)	Patient (geduldig)
Tempered (opvliegend)	Calm (rustig)

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