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BEYOND THE SHADOW OF A TRAIT: UNDERSTANDING DISCOUNTING THROUGH ITEM-LEVEL ANALYSIS OF PERSONALITY SCALES

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Temporal discounting, the loss in perceived value associated with delayed outcomes, correlates with a number of personality measures, suggesting that an item-level analysis of trait measures might provide a more detailed understanding of discounting. The current report details two studies that investigate the utility of such an item-level analysis. Study 1 demonstrates that discount rates correlate with the overall score as well as with 11 individual items on the Total Self-Control Scale (TSCS). Study 2 demonstrates a correlation between discount rates and the Consideration of Future Consequences (CFC) scale, but not with a measure of general self-efficacy. An item-level analysis of the CFC found that the CFC-Immediate subscale and four individual items correlated with discount rates. Overall, these two studies sketch an initial picture of how item-level analyses of existing trait measures can better inform our understanding of discounting.
Key words: CFC scale, TSCS scale, impulsivity, personality measure, self-control, temporal discounting

"To them, I said, the truth would be nothing but the shadow of the images."
—Plato

In the "Allegory of the Cave," Plato asks Glaucon to imagine a cave in which prisoners are shackled so that they see only the back wall of a cave. Under these circumstances, the prisoners know the world only through shadows cast on the wall by strangers moving past the mouth of the cave. Plato argues that the distorted shadows would eventually become real to the prisoners as they develop explanations of the world through their interpretation of the shadows' characteristics and actions. The shadows are, of course, not the real world, but rather the representation of actions that

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manifest in the real world. While the shadows comprise as much truth of their surroundings as available to the prisoners, a full understanding would require a shift of focus from the shadows to the shadow casters.[1] Though not the original context in which the "Allegory of the Cave" was intended, this analogy can serve as a reminder that derived psychological measures are reflections of actual behavior.

One widely used, derived psychological measure is temporal, or delay, discounting (TD), which can be defined as (a) the decrease in the perceived (or psychological) value of an outcome as the time to its availability increases or (b) a decrease in the reinforcing value of an outcome as the delay to its occurrence lengthens (Critchfield & Kollins, 2001). The degree to which future rewards depreciate in value is well described using a form of Mazur's (1987) hyperbolic equation:

$$V_p = \frac{V}{1 + kD}, \tag{1}$$

where V_p is the present value of the outcome, V is the absolute value, D is the delay to the outcome's availability, and k is the discount rate; thus, k is a numerical index of reward/outcome devaluation as a product of extended delay—the larger the k value, the greater the impact of delay on outcome value. Most discounting studies determine the k value by asking participants to complete a series of choices between varying hypothetical monetary outcomes presented at different delays (D). Nonlinear regression using a hyperbolic equation like Equation 1 then estimates the k value based on the observed values of V_p at each of the presented delays. An alternative approach is to use the area under the curve (AuC), a model-free estimate of discount rates, to produce an estimate of discounting without the need for nonlinear regression (Myerson, Green, & Warusawitharana, 2001). Whether estimating a k value using nonlinear regression or using the AuC, the end result is that the discount rate is based on data from self-report measures and, thus, both the k value and AuC may be considered indirect estimates of real-world behavior.[2]

That k values are a reflection of real-world behaviors of interest is evident in a large literature documenting individual differences in discount rates. One of the most discussed contributions pertains to greater levels of discounting among substance abusers than non-drug-using controls. For instance, increased discount rates have been shown across a variety of substances, including alcohol (Petry, 2001a; Vuchinich & Simpson, 1998), cocaine (Coffey, Gudleski, Saladin, & Brady, 2003), heroin (Kirby, Petry, & Bickel, 1999), nicotine (Baker, Johnson, & Bickel, 2003; Bickel, Odum, & Madden, 1999), and opiates (Madden, Bickel, & Jacobs, 1999; Yi, Buchhalter,

1 This is, of course, a simplification of one element of the argument laid out by Plato in the allegory. However, it is unnecessary to fully develop his argument in order to highlight how the idea of shadows can illuminate our understanding of psychological processes.

2 An interesting comparison can be made between indirect measures and second-order dependent measures. Much of the literature in experimental behavior analysis relies on a second-order dependent variable: response rate. A response rate is an empirically derived measure of behavior that relies on two *directly observed* measures: number of responses and amount of time. As described above, discounting differs from response rate in that the measures used to calculate the discount rate are *indirectly observed* via self-report. The functional difference between second-order dependent measures and measures derived from self-report data is significant.

Gatchalian, & Bickel, 2007). Furthermore, research indicates that discount rates are *negatively* correlated with college GPA (Kirby, Winston, & Santiesteban, 2005), long-term financial strategies and/or savings (Joireman, Sprott, & Spangenberg, 2005), performance in a single-player prisoner's dilemma game (Harris & Madden, 2002; Yi, Johnson, & Bickel, 2005), frequency of cooperative choices on group tasks/activities (Critchfield & Atteberry, 2003), and lower levels of risky-choice behavior (Chesson et al., 2006; Dixon, Marley, & Jacobs, 2003; Odum, Madden, Badger, & Bickel, 2000; Petry, 2001b). The breadth of real-world behaviors that differ across individual discount rates highlights the usefulness of the discounting concept in understanding behavioral differences.

Because discount rates are associated with socially important behavioral patterns, it is important to develop a detailed understanding of the specific behavioral patterns that vary with discount rates. For example, the existing literature demonstrates that elevated discount rates are suggestive of increased drug consumption. However, substance abuse is associated with a variety of distinct behaviors that differ from those engaged in by non-substance-using controls. Which of these behavior patterns are reflected by the elevated discount rates? In general, the utility of measuring discount rates will increase as the number of specific behavioral patterns predicted by discount rates increases (Green & Myerson, 2004).

One strategy for identifying the component behaviors that correlate with discount rates is through the examination of existing inventories of behavior, such as personality scales. Like discounting, a personality scale is an aggregate measure of self-reported behaviors. However, while discounting tasks focus on a single behavioral dimension (choice between potential immediate and delayed payoffs), personality scales typically provide lists of distinct behaviors that have been shown to share some underlying relationship (the "trait"). A useful method for understanding the relation between a trait and the items used to calculate the trait is to think of the analogy of a nation (such as the United States) and its individual cities/townships (e.g., Los Angeles, New York). While the United States can, as a whole, be described as a single entity, it is recognized that this whole is a general description of discrete parts (a fact to which anyone who has experienced both New York and Los Angeles would attest). The same is true of trait measures. The total score on the measure is a general overview of a series of choices. The individual items, however, contain additional information that is often "lost" when added into the total score (similar to the loss of information when one generalizes about the United States as a whole as opposed to New York and Los Angeles separately).

Considering that a personality measure consists of both a trait score and individual items, it is possible to use these existing behavioral inventories to better understand the behaviors associated with observed discount rates by examining the overall score and the individual items on the trait measure. The first part of this process—comparing discount rates to overall scores on trait measures—has been done with some success. Several studies demonstrate that discount rates correlate with diverse types of trait measures, including the Impulsivity (Madden, Petry, Badger, & Bickel, 1997; Richards, Zhang, Mitchell, & de Wit, 1999) and Extraversion (Richards et al., 1999) subscales of the Eysenck Personality Inventory (Eysenck, Eysenck, & Barrett, 1985), impulsivity scores on the Eysenck Personality Questionnaire-Revised

(EPQ-R; Ostaszewski, 1996), the Barratt Impulsiveness Scale (Kirby et al., 1999), the Impulsiveness and Adventuresomeness subscales of the I-5 (Kirby et al., 1999), the Disinhibition scale of the Sensation Seeking Scale (Richards et al., 1999), the Experience Seeking, Disinhibition, and Liveliness scales of the I-5 (Vuchinich & Simpson, 1998), and the Thrill and Adventure Seeking subscale of the Sensation-Seeking Scale-Version V (Vuchinich & Simpson, 1998). The correlations between discount rates and these personality measures suggest that some of the behaviors used to create the personality measures comprise items that relate to discount rates.

The current investigation focused on the second step in the two-step process suggested previously by comparing discount rates to the individual items that make up a personality measure. Although correlations between discount rates and personality scales are informative, the existing literature offers little insight into the specific items on personality scales with which discount rates are most closely associated. Returning to the United States analogy, demonstrating that discount rates correlate with a personality measure is tantamount to knowing only that a person is from the United States. This information is useful, but it still leaves a lot of territory to cover. By conceptualizing a personality scale as a list of items representing related behaviors, an item-level analysis shifts the level of analysis from a comparison of derived "psychological shadows" toward an investigation of the behaviors that cast the shadows. Moreover, approaching personality measures in this way may allow one to "see" the behavioral overlap between discounting and personality measures, which will aid in mapping out the meaningful relations between discounting and trait measures of behavior.

Study 1

The focus for this study was on the relation between the individual items on the Total Self-Control Scale (TSCS; Tangney, Baumeister, & Boone, 2004) and discount rates derived from a computer-based measure of discounting. The TSCS is a general trait measure of self-control that correlates *positively* with a breadth of "good" behaviors, such as grade point average, decreased alcohol abuse, relationship quality, interpersonal skills, and psychological adjustment (Tangney et al., 2004). Additionally, Schmeichel and Zell (2007) demonstrated that participants with high scores on the TSCS performed better on two behavioral tests of self-control: refraining from blinking during a 2-min test period and spending time with a hand submerged in cold water.

The TSCS was selected for evaluation in the current study not only because of its wide acceptance as a trait measure of self-control but also because it shares some of the same correlates as that of TD (e.g., drug abuse, grade point average). Finally, there is reason to believe that TSCS scores and discount rates correlate above and beyond a simple demonstration of mutual behavioral relations. For instance, Joireman, Balliet, Sprott, Spangenberg, and Schultz (2008) found a positive correlation between scores on the TSCS, the Consideration of Future Consequences (CFC; Strathman, Gleicher, Boninger, & Edwards, 1994) scale, and the CFC-Future subscale (an index of the degree to which the long-distance outcomes are included in current decisions). A negative correlation was also observed between TSCS scores and the CFC-Immediate subscale (a measure of the degree to which immediate outcomes are weighted). Joireman and colleagues further demonstrated

negative relations between discount rates and scores on the CFC-Immediate scale but not the CFC-Future scale. However, a direct comparison was not made between TSCS scores and temporal discounting.

Method

Participants. One hundred fifty-one (n = 151) undergraduate students participated in the study (55% female; n = 83), with an average age of 20.14 (SD = 4.63) years. Participant age did not differ across gender (t_{148} = –1.40, p = .16).

Measures. The following measures were used to assess overall self-control and temporal discounting.

TSCS. Participants completed a computer-based version of the TSCS. The 36-item scale presented one statement at a time, with item order randomized across participants. Sample items include "I am good at resisting temptation," "I never allow myself to lose control," and "I eat healthy foods." Each item was scored on a Likert-type scale ranging from 1 (*not at all*) to 5 (*very much*) based on how accurately the participant felt the items described their typical behaviors. Scores on the TSCS range from 36 to 180, with higher scores representing greater self-control.

TD. This study used Charlton and Fantino's (2008) adaptation of the computer-delivered quick-adjusting procedure. During the task, participants responded to a series of binary choices of the following form: (a) $X now or (b) $100 in [delay]. The amount presented immediately (X) varied from $0 to $100 according to a predetermined decision tree adapted from Critchfield and Atteberry (2003). The adjusting algorithm increased the value of X following a choice of the larger, delayed outcome (b) and decreased the value of X following a choice of the smaller, immediate outcome (a). The program presented seven [delay] values in Choice b: 1 day, 2 days, 1 week, 1 month, 2 months, 6 months, and 1 year. Delays presented from shortest to longest. Each delay presented until the algorithm provided an estimated value of X that the participant perceived as equal to $100 after the specified delay (the indifference point, V_p). The adjusting algorithm required a maximum of seven choices per delay, for a maximum of 49 choices total on the TD task. The seven indifference points were used to estimate individual discount rates, that is, the k in Equation 1. The higher the k value, the steeper the discounting curve or the greater the loss in value for delayed outcomes. Only hypothetical rewards were used, as an extensive literature suggests no differences in discounting between real and hypothetical rewards in discounting tasks (Johnson & Bickel, 2002; Lagorio & Madden, 2005; Madden, Begotka, Raiff, & Kastern, 2003; Madden et al., 2004). Although the outcomes were hypothetical, participants were instructed to act as if they were real.

Procedure. Both tasks were completed in a computer lab accommodating a maximum of five participants simultaneously. Participants completed the TSCS, a brief filler task unrelated to the current study, a demographic survey, and then the temporal discounting task. The order of task completion was the same for all participants.

Results

TSCS. The average score for the participants on the TSCS was 120.32 (SD = 18.615). TSCS scores did not differ across gender (t_{149} = –.90, p = .37).

The computer-delivered TSCS showed good internal consistency (Cronbach's alpha = .88).

TD. Using the indifference points from each of the seven delays, discount rates were estimated through (a) nonlinear regression (calculated using GraphPad Prism® software) to estimate the *k* value in Mazur's (1987) hyperbolic discounting equation (Equation 1) and (b) AuC, the model-free estimate of temporal discounting (Myerson et al., 2001). Note that level of impulse control decreases with *k* values and increases with AuC scores.

The median indifference points at each of the delays were as follows: 1 day = \$99 (interquartile range [IQR] = 10); 2 days = \$96 (IQR = 10); 1 week = \$93 (IQR = 39); 1 month = \$80 (IQR = 43); 2 months = \$70 (IQR = 53); 6 months = \$50 (IQR = 60); and 1 year = \$50 (IQR = 60). A nonlinear fit using these median indifference points for each of the seven delays produced an estimated *k* value of .005 (see curve illustrated in Figure 1) with a variance accounted for (r^2) of .894. The nonlinear fits were also calculated for each individual participant. The distribution of individual discount scores produced a median discount rate of .006 (IQR = .02, median r^2 = .80). The median AuC was .59 (IQR = .48). The distribution of both *k* values and AuC was nonnormal. A logarithmic transformation of the *k* values produced a normal distribution, with a mean log(*k*) of −5.21 (*SD* = 2.60). The log(*k*) and AuC values were highly correlated with each other (Spearman's rank order: $r = -.93$, $p < .001$).

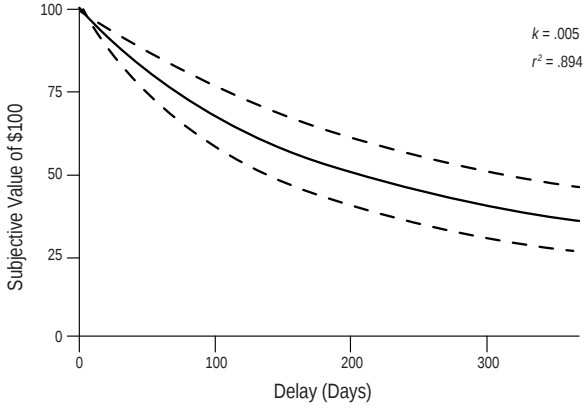

Figure 1. Best fit line to the median indifference points for Study 1. Dashed lines represent the 95% confidence interval.

TD and the TSCS. Because the AuC values were not normally distributed, Spearman rank-order correlations were calculated between the overall score on the TSCS and both the log(*k*) and AuC discounting indices. Both correlations were significant with log(*k*):TSCS = −.18, $p = .026$, and AuC:TSCS = .182, $p = .026$. Kendall's tau correlation was used to evaluate the 36 item-level correlations because the TSCS items are nonnormally distributed ordinal data (scored from 1–5). Given that lower log(*k*) values are associated with less discounting, a negative correlation is expected between log(*k*) and TSCS scores, while a positive correlation is expected for AuC. The correlations between log(*k*) and the individual TSCS questions ranged from −.247 ($p = .001$) to .111 ($p = .176$). Of 36 such correlations, 26 were in the anticipated negative

direction, 11 significantly so. The item-by-AuC correlations ranged from −.120 (p = .142) to .267 (p = .001). Of 36 such correlations, 31 were in the anticipated positive direction, 11 significantly so. See Table 1 for a list of items that produced significant correlations.

Table 1
*Correlations Between the Overall TSCS Scores, log(*k*), AuC, and the 11 Items From the TSCS That Correlate Significantly With the Discounting Measures*

		Log(*k*)		AuC	
		r	*p*	*r*	*p*
	Overall TSCS Score	−.181	.025	.181	.026
#	Question text				
1	I am good at resisting temptation.	−.146	.019	.145	.019
13	I refuse things that are bad for me.	−.124	.041	.130	.032
14	I spend too much money. (R)	−.171	.004	.161	.007
15	I keep everything neat.	−.124	.039	*.098*	*.105*
22	People would say I have iron self-discipline.	−.124	.043	*.102*	*.097*
26	I engage in healthy practices.	−.157	.011	.135	.029
28	Pleasure and fun sometimes keep me from getting work done. (R)	−.128	.035	.134	.028
29	I have trouble concentrating. (R)	−.121	.046	*.103*	*.090*
30	I am able to work effectively toward long-term goals.	−.159	.010	.140	.024
33	I lose my temper too easily. (R)	−.185	.002	.166	.006
35	I sometimes drink or use drugs to excess. (R)	−.186	.003	.206	.001

Note. Italicized correlations were not significant. Items marked with (R) are reverse scored.

Discussion

Performance on the discounting measure was weakly, but significantly, correlated with the overall TSCS score. This correlation can be viewed as evidence that the two measures do contact some of the same behaviors. Exactly where this contact occurs is better understood by looking at the 11 items that correlate significantly with discount scores (see Table 1). A general conclusion from these 11 items is that discount rates appear to correlate with items that relate to making *current* choices that provide better long-term outcomes. For example, three items that correlate with discount rates read: (1) "I am good at resisting temptation," (2) "I spend too much money" (reverse scored), and (3) "I engage in healthy practices." Interestingly, items that might suggest an ability to engage in delay-of-gratification behaviors ("People can count on me to stay on schedule") or impulsive behaviors ("I blurt out whatever is on my mind," "Sometimes I can't stop myself from doing something, even if I know it is wrong") did not correlate significantly with observed discount rates.

Study 2

Study 1 demonstrated the utility of the item-level analysis through the identification of 11 questions from the TSCS that correlate with discount rates. As noted previously, the 11 TSCS items that correlate with discount rates suggest that discounting is more a measure of how future delays are used in making immediate decisions than a measure of an individual's ability to wait for future outcomes. Study 2 (conducted concurrently with Study 1, although undertaken for somewhat different purposes) further explored this proposition by comparing discount rates to two other personality measures: the Consideration of Future Consequences scale (CFC; Strathman et al., 1994) and a measure of self-efficacy. The CFC scale evaluates the degree to which respondents include future outcomes in decision making. The CFC makes an interesting comparison measure because it has been shown to correlate with both TSCS scores and discount rates (Joireman et al., 2008). However, discount rates in the study by Joireman and colleagues were of stronger relation to the CFC-Immediate subscale while scores on the TSCS correlated more strongly with the CFC-Future subscale.

In addition to TD and the TSCS, overall scores on the CFC also relate to self-efficacy (Sirois, 2004). Self-efficacy (SE) is a critical concept in social and positive psychology regarding an individual's belief in his or her ability to effect personal life changes and to influence the future outcomes a person experiences. While the current SE scale is a general measure of self-efficacy, a frequent practice is to modify SE scales to reflect a specific aspect of life such as fitness, school, or relationships. This construct is a staple of various subfields of psychology and has been found to correlate with many different personality and impulsivity measures. Although SE and overall CFC scores correlate (Sirois, 2004), a relation between SE and discounting has not been explored.

Method

Participants. One hundred college students completed a survey delivered online over SurveyMonkey.com. Due to a technical problem, gender and age were collected for only 29 of the 100 participants. The average age of these 29 participants was 21.52 (SD = 6.86) years, and 76% (22 of 29) were female.

Measures. The following measures were used to assess temporal discounting and the consideration of future consequences.

TD. The TD measure was an adaptation of Beck and Triplett's (2009) discounting procedure and consisted of seven fill-in-the-blank questions.[3] Each question was framed as "The most I would pay for $1,000 delayed by [delay] is _____." Participants responded to this prompt by selecting a dollar amount ranging from $0 to $995 from a drop-down list to the right of each question. As in Study 1, all monetary amounts were hypothetical. Seven delay values were tested: 1 day, 1 week, 1 month, 6 months, 1 year, 5 years,

3 The discounting procedures in Study 1 and Study 2 are markedly different. The two studies were conducted concurrently as subparts of a larger set of studies. Unfortunately, because the studies began as separate investigations with distinct objectives, some procedural differences exist. However, given that the purpose of including Study 2 is to further demonstrate the value of the item-level analysis, the procedural differences do not impede the realization of the objective of Study 2 or the overall goal of this article.

and 10 years. The instructions given to the participant read, "For each question below, indicate the MOST money ($) you would be willing to pay right now to purchase $1,000 available after the specified delay." No other instructions were provided.

CFC. The CFC scale is a frequently used personality construct that quantifies the level of emphasis an individual places on the immediate (CFC-I) and future (CFC-F) outcomes of his or her behavior. (As one might anticipate, the CFC-I and CFC-F subscales are negatively related but remain distinct, as it is possible for a person to ignore immediate outcomes while attending to future outcomes or vice versa.) The CFC measure contains 12 items, each rated on a 7-point Likert scale ranging from 1 (*extremely uncharacteristic*) to 7 (*extremely characteristic*). The range of scores on the CFC is from 12 to 84.

SE. The SE scale is a frequently used measure of a person's belief in his or her ability to influence life outcomes (Jerusalem & Schwarzer, 1992). This 10-item assessment includes statements such as "If someone opposes me, I can find the means and ways to get what I want" and "I can usually handle whatever comes my way." As employed here, the SE scale was modified from a 4-point Likert-type scale to a 7-point Likert-type scale for consistency among the SE and the CFC questions.

Procedure. Participants selected the study from a list of available projects on an Internet-based subject pool that, upon registration, provided a link to the questionnaire. The survey presented the TD task, the CFC, and the SE scale and collected demographics (for the final 29 participants). Completion of the survey required about 10 min and could be completed anywhere an Internet-capable device was available.

Results

TD. Since the seven-question discounting task is different from traditional binary choice measures, the adequacy of this survey as a measure of discounting was explored. First, the internal consistency of the measure was evaluated using Cronbach's alpha ($\alpha = .92$). This high alpha value suggests that the measure is unidimensional and highly reliable. Second, a visual analysis of the seven discounting question medians and interquartile ranges revealed a decrease in monetary preference as a product of increased delay (*Mdn* in U.S. dollars, IQR listed inside parentheses): 1 day = $675 (710), 1 week = $500 (700), 1 month = $400 (700), 6 months = $250 (500), 1 year = $200 (435), 5 years = $100 (330), and 10 years = $80 (195). Finally, an estimate of individual consistency across delays was calculated. This index was created by summing the total number of adjacent delay pairs (e.g., 1 day/1 week, 1 week/1 month; six pairs in total) when the sooner outcome was greater than or equal to the more delayed outcome. The mean number of consistent pairs per participant was 5.11 ($SD = 1.14$) out of 6. Ninety-two (92) of the 100 participants were consistent on four or more pairs, with 46 of these consistent on all six. These three pieces of evidence (high internal consistency, general decreasing trend, and high consistency across participants) suggest that the fill-in-the-blank survey was an adequate estimate of discounting.

Because the discounting task produced reliable data that conformed to the general discounting hypothesis, nonlinear fits to the standard hyperbolic discounting model (Equation 1) were calculated both for the

group—using the median indifference points—and for each participant. At the group level, the nonlinear fit produced a discount rate (k) of .095 with a variance accounted for (r^2) of .757 (see Figure 2). The individual fits produced a similar distribution of discount rates with a median k of .09 and a median r^2 of .86. Discount rates were log-transformed (M = −2.27, SD = 4.03) to correct for a strong positive skew in the data. As in Study 1, the AuC values were also calculated. The Spearman correlation between log(k) and AuC was −.73 (p < .001). AuC data were nonnormally distributed with a median of .15 (IQR = .298). All data comparisons used the log(k) transformed discount rates and AuC values.

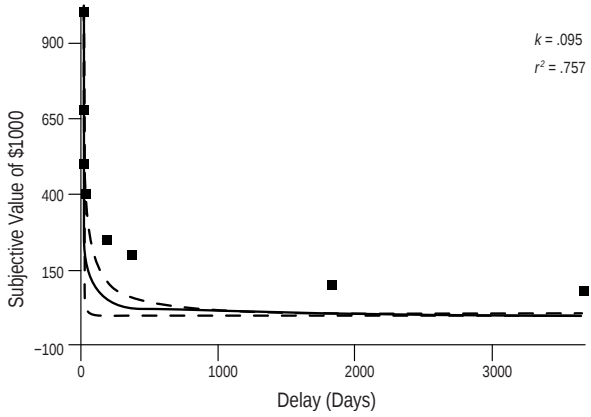

Figure 2. Best fit line to the median indifference points for Study 2. Dashed lines represent the 95% confidence interval.

CFC. The CFC scale produces a score ranging from 12 to 84. The mean CFC score for the current sample was 55.89 (SD = 11.26). Based on Joireman and colleagues' (2008) findings relating to the two subscales of CFC, each participant's scores on the two subscales were calculated. The mean CFC-I score was 31.89 (out of 49; SD = 7.99), and the mean CFC-F score was 24.07 (out of 35; SD = 5.87). The interscale correlations (Pearson) were as follows: CFC:CFC-F = .726 (p < .001), CFC:CFC-I = −.870 (p < .001), and CFC-F:CFC-I = −.292 (p = .003). These results are consistent with Joireman and colleagues' (2008) findings concerning the bidimensionality of the CFC scale.

SE. While a 7-point scale was used on the SE measure in order to match the CFC scale, final scores were converted ([total score / 70] × 40) to a range of 0 to 40 for consistency with the SE literature. The mean SE score was 31.46 (SD = 5.84). Reliability analyses indicated that the online survey had good internal consistency (Cronbach's alpha = .94).

CFC and TD. The relation between the CFC and log(k) was evaluated for the CFC, CFC-I, and CFC-F scales (see Table 2), plus each of the 12 items from the CFC. As shown in Table 2, log(k) scores were correlated with the overall CFC score (r = −.237, p = .018) and the CFC-I subscale (r = .232, p = .021). The correlation between log(k) and the CFC-F score was not significant. The correlations between CFC, CFC-I, CFC-F, and the AuC score were also nonsignificant. The item-level analysis identified four questions that

correlated with discount rates. These questions (and the correlations) are shown in Table 3.

Table 2
The Pearson Correlation Coefficients (r) From Study 2 Between log(k), AuC, the Consideration of Future Consequences Scale (CFC), the CFC-Immediate Subscale, the CFC-Future Subscale, and the Self-Efficacy Scale

	AuC	CFC	CFC-I	CFC-F	SE
Log(*k*)	−.73 *	.24*	−.23*	−.12	−.14
AuC		.09	−.08	.034	.21*
CFC			.88**	.73**	.33**
CFC-I				−.40*	−.22*
CFC-F					.43**

* $p < .05$. ** $p < .01$.

Table 3
Study 2 Correlation Summary for log(k) and AuC Across Consideration of Future Consequences (CFC) Scale, Self-Efficacy Scale, and the Individual CFC Items That Correlate With Discounting

		Log(*k*)		AuC	
		r	*p*	*r*	*p*
	Self-Efficacy	−.140	.163	.205	.041
	CFC-Total	−.159	.021	.066	.340
	CFC-Immediate	.158	.022	−.058	.400
	CFC-Future	−.082	.242	.019	.785
#	Question Text				
4	My behavior is only influenced by the immediate (i.e., a matter of days or weeks) outcomes of my actions. (R)	.201	.006	−.084	.251
6	I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes.	−.211	.004	.133	.073
7	I think it is important to take warnings about negative outcomes seriously even if the negative outcome will not occur for many years.	−.161	.037	.137	.065
11	I only act to satisfy immediate concerns, figuring that I will take care of future problems that may occur at a later date. (R)	.190	.010	−.100	.175

Note. Items marked with (R) are reverse scored.

SE and TD. As shown in Table 2, the correlation between log(*k*) and SE was negative but not significant ($r = -.140$, $p = .163$). While the correlation

failed to reach significance, it is in the anticipated negative direction (consistent with the idea that high discounters show lower self-efficacy). The correlation between AuC and SE scores was positive and significant ($r = .205$, $p = .041$). The analysis of individual items found one question ("I am confident that I could deal with unexpected events") that correlated with the AuC measure ($r = .148$, $p = .046$) and approached significance with log(k) ($r = -.139$, $p = .061$). Though not significant, all 10 questions showed the anticipated negative correlations with log(k) values and positive correlations with AuC (both indicating that lower discount rates were generally associated with higher SE scores).

SE and CFC. While not a central component of the current study, the correlation between SE and the CFC scales was evaluated (see last column of Table 2). SE correlated with the overall scale ($r = .33$, $p = .001$), the CFC-F ($r = .438$, $p < .001$), and the CFC-I scale ($r = -.219$, $p = .030$).

Discussion

Correlations involving discounting, the CFC scale, and SE suggest an intriguing story. In the present study, discount rates correlated most strongly with the CFC-I subscale, and SE correlated most strongly with the CFC-F subscale. Discounting and SE were very weakly related to one another. The seemingly contradictory results—mixed correlations between some but not other ostensibly similar aspects of personality traits—are consistent with findings in the discounting literature (see Green & Myerson, 2004, for a discussion). Fortunately, the item-level analysis helps clarify these apparent inconsistencies. As with Study 1, the items that correlated most strongly with discount rates involved current decisions. Items that relate to making future decisions ("I consider how things might be in the future and try to influence those things with my day-to-day behavior" and "Often I engage in particular behavior in order to achieve outcomes that may not result for many years") do not correlate strongly with discount rates. SE, on the other hand, correlates with both of these items. As these results suggest, discounting is about making immediate decisions (which includes an evaluation of future outcomes), whereas SE is more of a focus on future possibilities/outcomes.

General Discussion

Impulsivity is increasingly being recognized as a multidimensional construct within which temporal discounting operates (de Wit, 2008; Holt, Green, & Myerson, 2004; Monterosso & Ainslie, 1999). Measures such as the TSCS and the CFC scale may be additional tools for examining other dimensions of impulsivity. The goal of the current article was to demonstrate that a better understanding of how these pieces of the impulsivity puzzle fit together can be achieved through item-level analyses of trait measures.

In practice, the item-level analysis discussed here is best viewed as a two-step process. Step 1 involves the comparison of discount rates with overall trait scores. These comparisons are best suited for finding areas of behavioral overlap as well as areas that are largely distinct. When these comparisons reveal overlap between measures, Step 2 is to conduct an item-level

analysis of the component elements of the trait measure. This more detailed analysis is useful in identifying those behavioral dimensions that are shared between the two measures. For example, results from the two current studies demonstrated that discount rates appeared to correlate most strongly with questions regarding current choices (e.g., TSCS: "I engage in healthy practices"; CFC: "I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes"). On the other hand, those items that suggest an inability to control impulses (e.g., TSCS: "People would describe me as impulsive" and "I do many things spur of the moment") did not correlate with discount rates.

The information gained from item-level analyses can be used for at least two major extensions of the discounting literature. First, the components identified from item-level analyses can be combined to create new, albeit supplementary, measures of discounting. A trait measure of discounting designed to employ a simple Likert-style scale—similar to those used in other trait measures—of behaviors frequently engaged in by high and low discounters would allow for greater ease of administration by practitioners/researchers and decreased response demands imposed on participants. Additionally, many trait measures are easy to score and would not require nonlinear regression (*k* values) or the estimation of AuC values. A first step in constructing this type of measure is the identification of candidate behaviors for inclusion. The current study suggests 15 candidate questions (see Tables 1 and 3) for this measure.

Second, the item-level analysis brings discounting researchers into greater contact with the vast personality literature. Because personality theorists are highly skilled in the creation of behavioral inventories that map onto a general behavioral characteristic/trait, taking advantage of their expertise might allow for faster growth in the understanding of the behaviors that are most influenced by changes in discount rates.

There are two procedural elements of the current studies that are worth extra consideration. First, both studies used a fixed order of task presentation, which makes it difficult to evaluate any possible interactions between the measures. Further, this rigid task order (Study 1: TD, TSCS; Study 2: TD, CFC, SE) did not allow for testing of the possibility that completion of an earlier task and/or response fatigue had a systematic effect on the observed pattern of associations between the measures. Fortunately, any order effects would have been consistent across participants as all participants experienced the same task order. Second, the distinction between a question that correlated with discounting and one that did not was based on the observed *p* value. While the use of this statistical rule simplified the judgment process, additional work is needed to identify the real-world significance of these statistical differences.

The current exploratory study provides initial encouragement for the value of investigating the component questions in selected personality measures. This approach has the potential to improve understanding of the behaviors that relate to observed discount rates. Of course, the items identified in this limited investigation most likely represent but a small sample of the behaviors related to discounting. Additional systematic investigations of existing trait measures are needed in order to provide a more defined picture of discounting.

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