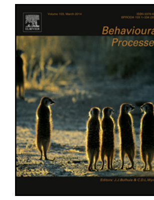
Behavioural Processes 103 (2014) 256–260

Contents lists available at ScienceDirect

Behavioural Processes

journal homepage: www.elsevier.com/locate/behavproc



Short report

Item-based analysis of delayed reward discounting decision making

Joshua C. Gray[a], Michael T. Amlung[a,b], John D. Acker[a], Lawrence H. Sweet[a,c], James MacKillop[a,d,*]

[a] Department of Psychology, University of Georgia, Athens, GA 30605 , USA
[b] Department of Psychological Sciences, University of Missouri, Columbia, MO 65211, USA
[c] Department of Psychiatry and Human Behavior, Brown University, Providence, RI 02911, USA
[d] Department of Behavioral and Social Sciences, Brown University, Providence, RI 02911, USA

ARTICLE INFO

Article history:
Received 10 July 2013
Received in revised form
12 December 2013
Accepted 2 January 2014
Available online 15 January 2014

Keywords:
Decision making
Delay discounting
Impulsivity
Reward

ABSTRACT

Delayed reward discounting (DRD) is a behavioral economic index of time preference, referring to how much an individual devalues a reward based on its delay in time, and has been linked to a wide array of health behaviors. It is commonly assessed using a task that asks participants to make dichotomous choices between two monetary rewards, one available immediately and the other after a delay. This study sought to shorten an extended iterative DRD assessment to increase its versatility and efficiency. Data were drawn from two young adult samples, an exploratory sample ($N = 130$) and a confirmatory sample ($N = 247$). In the exploratory sample, eight items were identified as predicting the majority of the variance in the full task area under the curve (AUC) ($R^2 = .821$; $p < .001$). In the confirmatory sample, the same eight items similarly predicted the majority of variance in the full task AUC ($R^2 = .844$, $p < .001$). These results provide initial support for the validity of a brief 8-item assessment of DRD. Priorities for further validation and potential applications are discussed.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction

Impulsivity can be broadly characterized as acting “with relatively little forethought” (Dickman, 1990, p. 99). Rather than being a single construct, however, efforts to operationalize impulsivity have illuminated its multifactorial nature. The diverse aspects of impulsivity include risk taking, an impaired ability to inhibit prepotent responses, lack of judgment of negative consequences, reactivity to emotional states, and delayed reward discounting (DRD) (de Wit et al., 2007; Logan et al., 1997; Swann et al., 2002; Whiteside and Lynam, 2001).

This latter index, DRD, is a behavioral economic index of how much an individual devalues a reward based on its delay in time. Impulsive DRD is a core feature of several psychiatric disorders that are characterized by excessive choice of immediate rewards at the cost of long-term outcomes. For example, impulsive DRD has been associated with a range of addictive behaviors, such as tobacco, cocaine, opiate, and alcohol dependence (MacKillop et al., 2011). Furthermore, impulsive DRD has been associated with attention-deficit/hyperactivity disorder (ADHD) (Scheres et al., 2010; Wilson et al., 2011). This over-orientation toward immediate rewards is thought to be a core deficit in ADHD (Tripp and Alsop, 2001). In addition, impulsive DRD has been inversely associated with an array of health behaviors, including mammogram, prostate, and dental screenings; asthma adherence; exercising; responsiveness to hypertension diagnosis, and flu shot utilization (Axon et al., 2009; Bradford, 2010; Brandt and Dickinson, 2013).

Delayed reward discounting is characteristically assessed with a behavioral task (MacKillop et al., 2011). Originally, the DRD task was non-randomized and systematically assessed preferences for immediate versus delayed rewards with a titrating function that sequentially decreased (or increased) reward discrepancy and increased delay time (Rachlin et al., 1991). Subsequently, randomized tasks have increasingly been used to improve the resolution of participant preferences independent of systematic sequences of choices (Amlung et al., 2012; Boettiger et al., 2007). A fully permuted and randomized task is in many ways an ideal assessment as it systematically characterizes choice preferences at multiple delay lengths and allows for examination of consistency in reward preferences to assess validity. These DRD tasks exhibit good validity, but require as long as 20 min to complete (e.g., MacKillop et al., 2006), reflecting relatively high assessment burden. More recently, iterative tasks have been made more efficient by using adaptive adjusting procedures to hone in on preference reversals (Sheffer et al., 2011). However, even with this step, DRD tasks are often too

* Corresponding author at: Department of Psychology, University of Georgia, Athens, GA 30602, USA. Tel.: +1 706 542 3033; fax: +1 706 542 3275.
E-mail address: jmackill@uga.edu (J. MacKillop).

http://dx.doi.org/10.1016/j.beproc.2014.01.006
0376-6357/© 2014 Elsevier B.V. All rights reserved.

lengthy for time-limited clinical settings or large-scale epidemiological or economic surveys.

Previous efforts have been made to shorten the task, the most prominent being the Monetary Choice Questionnaire (MCQ; Kirby et al., 1999), which consists of 27 randomized choices across three reward magnitudes. The task has even been distilled into single-item and two-item assessments (Anokhin et al., 2011; Reimers et al., 2009), but these measures are necessarily relatively low resolution and have been found to reveal smaller effect size associations with health behaviors (MacKillop et al., 2011). Additionally, matching (i.e., fill-in-the-blank) has been proposed as a method for circumventing ordering effects of choice questions and for shortening length of testing, however, comparatively fewer psychological studies use this strategy and choice formats have been found to reveal higher associations between discounting and health behaviors (Hardisty et al., 2013). Notably, no studies to date have systematically examined the extended DRD task to determine the most predictive items toward developing a more efficient DRD assessment.

The utility of a brief version extending across delay amounts and times would reduce assessment burden, allowing greater inclusion of DRD assessment in both research and applied contexts. The goal of the current study was to examine item-level performance in the context of a full iterative DRD task. Using exploratory and confirmatory samples, we examined the relationship between individual item performance and over discounting preferences. We hypothesized that a smaller set of items would be able to substantially capture DRD preferences and would generalize across samples.

2. Method

2.1. Samples

Data were drawn from two undergraduate samples at the University of Georgia (exploratory $N = 130$; confirmatory $N = 247$). Participants were excluded if they did not respond to more than 25% of the DRD task items (exploratory = 0; confirmatory = 1) and for response consistency less than 75% (i.e., inconsistency in levels of future discounting; exploratory = 4; confirmatory = 3), reflecting poor effort. Participants were primarily female (77.7% exploratory/75.9% confirmatory), European American (85.1%/81.7%), and 20 years-old (20.3/19.6). Assessments took place during one-hour group testing sessions. Participants were compensated with research credit or extra credit for their time. All aspects of the studies were approved by the institutional review board and all participants provided informed consent.

2.2. Assessment

Comprehensive demographics were assessed, including sex, age, race, gender, income, education and other descriptive variables. During the DRD task, participants chose between a larger delayed reward (LDR; $100 after 1 day, 1 week, 2 weeks, 1 month, 6 months or 1 year) and a smaller immediate reward (SIR; $1, $10, $20, $30, $40, $50, $60, $70, $80, $90, $99) that was available today. Items were ordered in a semi-randomized sequence that contained no consecutive trials with both adjacent small reward magnitudes and identical delay lengths. The task was administered via a PowerPoint presentation that was projected onto a large screen. Each item was presented for 6 s with a 2 s interstimulus interval, and there was a 15-s break in the middle of the task. Participants were instructed to check a box on a response sheet corresponding to their choice of the larger delayed reward (LDR) or smaller immediate reward (SIR) presented.

2.3. Data analysis

The data were screened for outliers, defined as $Z > 3.29$, but none were present (Tabachnick and Fidell, 2007). Points of indifference (i.e., where participants begin to value the SIR over the LDR) were calculated based on the smallest amount of money chosen to be received immediately instead of waiting the specified delay to receive $100 (see Amlung and MacKillop, 2011). Area-under-the-curve (AUC) scores were generated as the index of temporal discounting; smaller AUC values reflect greater future discounting and impulsivity (see Myerson et al., 2001). In the exploratory sample, stepwise regression was used as a data-driven strategy for identifying the most influential items for predicting the full task AUC. All 66 items from the exploratory sample were entered into a multiple regression that iteratively retained items that accounted for incremental additional variance at $p < .10$. The trend-level significance threshold was chosen to avoid prematurely eliminating items during successive steps. As considerable overlap was expected among item performance, and was indeed present, items exhibiting a tolerance value < .40 were eliminated due to excessive collinearity (e.g., 0 = 100% collinearity) (Allison, 1998). Then, the regression was rerun with the remaining items that satisfied the tolerance threshold to identify items that offered significant and unique incremental variance in predicting the overall AUC. These remaining items were used to test the hypothesis that the reduced items would predict the majority of the variance accounted for by the full task AUC. The items identified in the exploratory sample were subsequently entered into a linear regression model in the confirmatory sample to test the second hypothesis of replicability across studies. Finally, the predictive relationship of the shortened scale at the individual level was assessed by computing the interquartile range (IQR) of the actual and predicted AUC and examining the difference between these. Of note, the difference in mean AUCs between actual and predicted values was not a meaningful metric because it is inherently zero.

To verify the generalizability of the shortened measure to alternative discounting characterization strategies, a hyperbolic discounting function was also generated utilizing Mazur's (1987) formula: $V = 1/(A + kD)$. V is the subjective value of the delayed reward (i.e., the indifference point), A is the amount of the delayed reward (i.e., $100), D is the delay, and k is the index of best-fit, indicating the overall rate of discounting within the model. Because the distribution of the k is typically positively skewed, it was log transformed to improve its distribution.

3. Results

There were no significant differences in the overall levels of impulsivity between the two samples (exploratory $M = .50$ (SD = .23); confirmatory $M = .47$ (.24)). Correlations between points of indifference of both samples demonstrated high intercorrelations between each delay and their most proximal delays (Table 1).

In the exploratory sample, the first step of the stepwise regression generated 25 items (out of 66 total items) which substantially predicted the full task AUC, $R^2 = .996$, $p < .001$. In the second stage, 12 items were removed for excessive collinearity (tolerance < .40). The stepwise regression was run again on the remaining 13 items, which resulted in eight items surviving the individual item threshold. The eight items supported the first hypothesis of predicting the majority of the full task AUC from the exploratory sample ($R^2 = .819$; $p < .001$). The eight items were comprised of varying immediate rewards spanning the delay duration continuum (i.e., 14 days, 30 days, 6 months, 1 year; see Appendix A).

In the confirmatory sample, the same eight items entered into a linear regression predicting the full task AUC from the

Download English Version:

https://daneshyari.com/en/article/8497345

Download Persian Version:

https://daneshyari.com/article/8497345

Daneshyari.com