



Substance use disinhibition associated with economically rational decisions to quit a boring task



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ABSTRACT

Preferences for smaller immediate rewards over larger delayed rewards have been associated with a range of negative outcomes, including substance use problems. The present research investigated a potential association between substance use disinhibition and preferences for an immediate reward in a situation where the delayed reward was not the largest. Participants recruited from Amazon Mechanical Turk were required to perform a boring, repetitive task for 25 min in order to earn a \$3 bonus. Alternatively, they could quit at any time to receive half the bonus. However, when one fourth the task remained, participants were offered the choice between (a) quitting the boring task for a \$3 bonus, and (b) continuing the boring task for a \$3 bonus. Participants who chose the economically superior option of quitting the task scored higher on a measure of substance use disinhibition and on the Disinhibition facet of Zuckerman's Sensation Seeking Scale.

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1. Introduction

The tendency to choose immediate rewards over larger later rewards is associated with a range of negative outcomes and traits. For instance, those with a preference for immediate rewards are more likely to have problems with gambling (Reynolds, 2006), have lower IQ (Shamosh & Gray, 2008), show poorer academic performance (Kirby, Winston, & Santiesteban, 2005), and are less likely to engage in various health behaviors (Melanko & Larkin, 2013). One perspective on the above associations is that people differ in their tendency to discount future outcomes. The connection between individual differences in such *delay discounting* and substance use has received particular attention in the research literature.

For instance, delay discounting has been linked to adolescent drinking and intoxication frequency (Rossow, 2008) and has been found to prospectively predict cigarette smoking in early adulthood in a longitudinal study (Audrain-McGovern et al., 2009). In comparison to control groups, higher levels of discounting is one of the characteristics of individuals who inject heroin/amphetamine (Bretteville-Jensen, 1999), alcohol dependent individuals (Petry, 2001), smokers (Bickel, Odum, & Madden, 1999), and a range of other groups of substance users (see MacKillop et al., 2011; Reynolds, 2006).

Despite the associations outlined above, there may be positive outcomes associated with the preference for immediate rewards, and the preference for delayed rewards may in some cases produce sub-optimal outcomes. For instance, Otto, Markman, and Love (2012) created a task that favored immediate choices, and found that impulsive individuals performed better than less impulsive individuals (as measured by the self-report scale BIS-11). That is, having a preference for delayed rewards was suboptimal due to the reward structure of that particular context. Furthermore, several researchers have proposed that choosing immediate gratification may be rational in situations characterized by uncertainty, for instance when length of the delay is uncertain (McGuire & Kable, 2013), and when expectations of the future rewards are low (Kidd, Palmeri, & Aslin, 2013; Mischel, 2011).

Thus, a preference for immediate rewards does not necessarily produce inferior decisions, but there is likely a better fit between preferences for delayed choices and the modern society. For instance, our bodies come equipped with the ability to accumulate fat and use it when resources are scarce, but this is not a particularly useful function today. The high availability of calorie-dense food and potent drugs therefore give an advantage to those who prefer to defer or limit consumption.

Although the use of alcohol and other drugs are associated with a range of severe problems (Babor, Caetano, et al., 2010; Babor, Caulkins, et al., 2010), the choice to use drugs is not inherently irrational (e.g., Müller & Schumann, 2011). The majority of those who try alcohol, cannabis, and other drugs never experience any severe

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problems with their use (see Atha, 2004; Kalaydjian et al., 2009; Warner, Kessler, Hughes, Anthony, & Nelson, 1995), and many of those with prolonged use are able to quit without any treatment (see e.g., Heyman, 2009). A provocative finding by Leigh, Bowen, and Marlatt (2005) is that mindfulness, a state of awareness associated with a range of well-being constructs (Brown & Ryan, 2003), was positively correlated with alcohol and tobacco use. Thus, despite the impression one may get from reading the research literature on intertemporal choices, neither a preference for immediate rewards, nor substance use, are inherently suboptimal behaviors.

In past research on intertemporal choices (e.g., studies on discounting and delay of gratification), the delayed reward has been the larger one, and failing to wait for this larger reward has been considered as an indication of impulsiveness or poor self-control (see e.g., Ainslie, 2005; Forstmeier, Drobetz, & Maercker, 2011; Kirby & Guastello, 2001; Mischel, Ayduk, & Mendoza-Denton, 2003). In contrast, the present research involves a situation where the rational option, at least in terms of economic gain, is to stop waiting and accept an immediate reward. More specifically, participants could quit at any time during the task for a small reward or continue until the end for a larger reward. However, when one quarter of the task remained, participants were given the option to quit for the large reward.

In terms of economic gain, there is no reason to continue the task when being offered the full payment for quitting; in the present context it inflicts a loss in terms of foregone earnings from other work, and it decreases the likelihood of obtaining the larger reward. For this reason, and because the task used in the present research was repetitive and boring, the choice to continue is referred to as inferior, suboptimal or irrational – although there may be other valid reasons to continue a boring task (see Halkjelsvik & Rise, 2015).

The purpose of the present research was to see whether the rational choice to accept an immediate reward over a delayed one could be linked to inclinations for substance use. In a sense, the idea is similar to that of Otto et al. (2012), who created a reward structure that favored choices of immediate rewards. However, they were not concerned with inclinations for substance use, and the reward structure was covert. In the present study, the potential consequences of participants' choices were fully disclosed.

A link between the type of choice presented above and an inclination for substance use can be expected based on the literature on perseverance and substance use. Several studies have linked substance use or substance use problems to a type of impulsiveness called *lack of perseverance* (Coskunpinar, Dir, & Cyders, 2013; Magid & Colder, 2007; Miller, Flory, Lynam, & Leukefeld, 2003; Verdejo-García, Bechara, Recknor, & Pérez-García, 2007; Whiteside & Lynam, 2003; Zapolski, Cyders, & Smith, 2009). Results from such studies, based on self-reported survey measures of perseverance, are not unanimous (e.g., Magid & Colder, 2007), and does not always hold when controlling for other types of impulsiveness (Lynam & Miller, 2004; Miller et al., 2003; Shin, Hong, & Jeon, 2012). However, also behavioral measures of task persistence are correlated with substance use (Quinn, Brandon, & Copeland, 1996). Furthermore, a factor analysis by Whiteside and Lynam (2001) showed that the Disinhibition facet of the Sensation Seeking Scale (Zuckerman, 1994), which includes items about disinhibited alcohol and drug use, partly loads on the lack of perseverance factor in a four factor model of impulsivity.

There are several differences between the above and the present studies. Our paradigm measures actual persistence in a repetitive and boring task after being offered a reward for quitting. Thus, there are no obvious good reasons to continue the task, and quitting is the best choice in terms of economic efficiency. Instead of focusing on substance use problems or one type of

substance use, the present research investigates an interest in, or an inclination toward, using different kinds of substances. This inclination may be less affected by incidental life circumstances than actual use is. In addition to this specific focus on substance use, the present article also reports results for a broader measure of disinhibited behavior, the Disinhibition facet of Zuckerman's Sensation Seeking Scale (e.g., Zuckerman, 1994).

A previous article (Halkjelsvik & Rise, 2015) utilizing the same data set as the present article reported that a substantial proportion of participants chose to continue the task even when they could receive the larger reward if they stopped. Based on the results from several experiments, the authors concluded that the main reasons for continuing were not enjoyment with the task or expectations of additional "hidden" rewards. Instead, people seemed to be governed by various persistence motives, such as an urge to complete tasks (cf. Ovsiankina, 1928), personal principles (never quit, keep one's promise), and desire for feedback.

The present paper expands on this research and investigates whether the choice to continue or quit could be linked to an inclination for substance use and more generally to disinhibited behavior. In contrast to the typical research on intertemporal choice, where the larger later rewards are implicitly considered as the best choice, the present research could link an inclination to use alcohol and drugs to the economically optimal decision to quit a boring task and obtain the immediate reward. Thus, we test the following two hypotheses:

H1: Participants who quit a boring task when the full reward has been offered score higher on a measure of substance-related disinhibition.

H2: Participants who quit a boring task when the full reward has been offered score higher on the Disinhibition facet of the Sensation Seeking Scale (Zuckerman, 1994).

2. Method

2.1. Participants and data

The data derive from 6 different experiments/studies where participants recruited from the online work marketplace Amazon Mechanical Turk (MTurk; see Berinsky, Huber, & Lenz, 2012; Casler, Bickel, & Hackett, 2013; Goodman, Cryder, & Cheema, 2013). Only participants with an approval rate of 99% or more for previous tasks on MTurk, at least 50 previous MTurk assignments completed, and US as the location of residence were permitted to participate. Age ranged from 18 to 70, $M = 33$, $SD = 11$. The proportion of female participants was .47, but varied from .37 to .57 between the 6 studies. The sample size varied greatly between studies (see Table 1) because some of the studies were designed with tests of differences between experimental conditions in mind, and not with a concern for testing individual differences. The denominations of studies in Table 1 (Study 1a, Study 1b, etc.) reflect those reported in a previous article on the same dataset (Halkjelsvik & Rise, 2015). One of the experimental conditions from this dataset is not reported in the present article (condition where participants chose to continue or quit after the task was completed). None of the current data on individual differences was reported in this previous publication.

2.2. Procedure

After completing a survey with measures of individual differences, participants received information about a "waiting task" that needed to be completed in order to earn the full bonus of \$3 (in addition to the base pay of \$1.5). Participants were informed that they could quit at any time during the task by pressing the

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