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Using delay discounting to understand impulsive choice in socially anxious individuals: Failure to replicate



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ABSTRACT

Background and objectives: Impulsive choice that follows transient anxiety responses is a potentially important outcome that may underlie maladaptive behavioral patterns that co-occur with high levels of social anxiety. However, little research has examined impulsive choice in relation to social anxiety. Rounds, Beck and Grant (2007; *Behavior Research and Therapy*, 45, 729–735) found that high social anxiety was associated with impulsive choice using a delay discounting procedure, but only in a non-threatening (control) condition, but several procedural confounds in that study may also explain the findings. The purpose of this study was to replicate Rounds et al. while controlling for potential procedural confounds.

Methods: High- and low-social anxiety adult college-students with no substance abuse history were assigned randomly to a public speaking condition or a control (silent reading) condition. In the middle of the task, participants completed a measure of delay discounting, which measures impulsive choice.

Results: Impulsive choice was not influenced by either social anxiety status or experimental condition.

Limitations: Other aspects of impulsive choice may be more sensitive to transient anxiety and fear. Higher state levels of social anxiety and transient anxiety may be necessary to detect a significant relationship with impulsive choice. Relatively high levels of impulsive responding may only occur in socially anxious individuals with current/historical substance abuse.

Conclusions: Neither anxiogenic laboratory procedures nor social anxiety status appear to influence impulsive choice as measured by the delay discounting task. Future research might consider examining whether transient anxiety influences other aspects of impulsive choice.

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1. Introduction

One broad definition of impulsivity is that it represents a “tendency to act spontaneously and without deliberation” (Carver, 2005), especially in relation to the potential long-term consequences of impulsive choices. In the context of social anxiety disorder, escape from anxiety-provoking situations can be viewed as an impulsive behavior in the sense that the escape response is motivated and maintained by short-term fear reduction, but without consideration of the potential benefit of remaining in the situation (e.g., fear decrement over time, learning that social interactions are not dangerous) or negative long-term effects of patterns of avoidance (e.g., impaired social and professional functioning).

According to Gray's (1982, Gray & McNaughton, 2000) revised Reinforcement Sensitivity Theory (RST), impulsivity and anxiety result from the activation of different neural systems: the reward-sensitive Behavioral Approach System (BAS) is activated in the context of positively-valenced stimuli, the Fight/Flight/Freeze System (FFFS) mediates reactions to conditioned and unconditioned aversive stimuli, and the Behavioral Inhibition System (BIS) represents a risk assessment system that is responsible for navigating goal conflict between the BAS and FFFS systems (Corr, 2004, 2008). Some recent research suggests that the BAS, which is typically associated with sensitivity to reward (and impulsivity), may be activated in situations that involve both the potential for reward, but also the possibility of escaping punishment (Franken & Muris, 2006). Mather and Lighthall (2012) argue also that conditions of stress increase the salience of rewards by modulating the dopaminergic reward system, which is associated with impulsive choice (Cardinal, Pennicott, Sugathapala, Robbins, & Everitt, 2001) and that activating dopaminergic activity also may increase approach to immediately rewarding and impulsive

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options (Schultz, 2006). This is consistent with research suggesting a connection between difficulties with self-control and the experience of negative emotion (Pawluk & Koerner, 2013; Tice, Bratslavsky, & Baumeister, 2001). Therefore, anxious individuals experiencing distress may engage in impulsive behaviors as a way to regulate their emotion.

Delay discounting is one aspect of impulsive choice (Bickel & Madden, 2010) and refers to the tendency for a reward to decrease in value as the time to receiving it increases. Delay discounting is measured in humans by establishing the current subjective value of a reward across a series of delays. Patterns of discounting can be described mathematically using a hyperbolic decay function (Mazur, 1987): $V = A/(1 + kD)$. In this equation, the V represents the subjective value of the delayed outcome or reward, A represents the amount of the delayed reward, D represents the delay to receiving the large reward, and k is a free parameter that indicates the rate of discounting. Higher k values are associated with a tendency to choose smaller, immediate outcomes over larger delayed outcomes and are associated with impulsivity. Higher rates of discounting are associated with a variety of substance abuse and other health problem behaviors (Bickel & Madden, 2010).

In spite of the relevance of impulsive choice in the context of social anxiety, very little research has examined the delay discounting paradigm and social anxiety jointly. Rounds, Beck, and Grant (2007) report the only study to date to specifically examine delay discounting in the context of fear and anxiety. In their study, high and low socially anxious individuals were assigned randomly to either a control condition or a “threat” condition in which they imagined giving an impromptu speech just before completing a delay discounting task. Contrary to their expectations, discounting rates were higher among high socially anxious participants, but only in the control (“non-threat”) condition. There was no effect of threat for either group.

Rounds et al.’s findings are potentially important, but they did not control for the influence of substance abuse on their findings. Procedural limitations may have obscured an otherwise clear relationship between anxiety and impulsive choice. Given the relationship between substance use problems and both social anxiety disorder (Kessler, Chiu, Demler, Merikangas, & Walters, 2005) and delay discounting (MacKillop et al., 2011), it is possible that substance abuse confounded otherwise clear relationships between anxiety and impulsivity. In addition, Rounds et al. did not incorporate a manipulation check in their study to determine whether their imagined public speaking scenario actually influence the emotional experience of the participants. The lack of a manipulation check prevents clear statements regarding the effectiveness of the anxiety induction itself.

The purpose of the current study was use methods similar to those used by Rounds et al. to examine the connection between the experience of fear and impulsive choice, but control for potential confounds.

2. Material and methods

2.1. Screening assessments

Participants were screened for substance use problems using the Fagerstrom Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991), the Short Michigan Alcohol Screening Test (SMAST; Selzer, Vinoker, & van Rooijen, 1975), and the Drug Use Questionnaire (DAST-10; Skinner, 1982). Social anxiety was measured using the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998).

2.2. Laboratory measures

Delay discounting was measured using a computerized task (Richards, Zhang, Mitchell, & de Wit, 1999) in which participants answered a series of questions about their preference for relatively small outcomes available immediately and a larger outcome available after a delay. The larger outcome was set at \$10 and the delay periods were 1 day, 1 week, 1 month, 6 months, and 1 year. The larger amount was held constant and the smaller amount of money was adjusted in \$.50 increments in a random adjusting procedure by the program until a value that represented the individual’s indifference point was arrived at for each of the delay periods. The computer program determined the small amounts based on responses from previous questions so that the range of values presented on subsequent questions was narrowed. The indifference point refers to the current “value” of large amount of money after the delay period. Directions for completing the task were given at the beginning of the session to avoid unnecessary interactions during the fear provocation procedure. Participants also rated their subjective discomfort from 0 (none at all) to 100 (extremely).

2.3. Procedure

Participants completed all screening measures online and received a small amount of research credit for their participation. Participants ($n = 113$) who exhibited either high or low levels of social anxiety (34 or higher and 20 or lower on the SIAS, respectively), little or no nicotine dependence (2 or less on the FTND), no alcohol use problems (3 or less on the SMAST), and no drug problems (3 or less on the DAST-10) were invited to participate in the experimental part of the study.

Upon arriving to the lab, the participants were assigned randomly to either to the public speaking condition or the reading (control) condition. A comparison of mean scores on the SIAS indicated that the low and high social anxiety groups differed on this measure, but not on any demographic variables (see Table 1). Upon arriving to the lab and providing consent, all participants were instructed to rest for five minutes, after which a baseline subjective anxiety (0 = no anxiety; 100 = extremely anxious) measure was taken. After baseline measure was taken, the experimenter explained the process of the study and participants proceeded according to their group assignment.

2.3.1. Public speaking task

Participants randomized to the public speaking condition were asked to give a 3-min speech on whether or not they agreed with capital punishment. Participants were given two minutes to silently prepare for their speech that took place directly in front of a video camera, placed 5 feet away from the participant. After the first minute and a half of the speech, the experimenter took a second SUDS measurement, participants completed the delay discounting task, and then completed the second half of their speech.

Table 1

Comparison of demographic and social anxiety variables between low- and high-social anxiety groups.

	High anxiety ($n = 50$)	Low anxiety ($n = 63$)	Test statistic (df)	p
Demographics				
Age (M, SD)	25.1 (8.2)	26.4 (8.8)	.84 ^a (111) ^a	ns
% Female	68.0	65.0	.11 ^b (1) ^b	ns
% Caucasian	90.0	88.9	2.21 ^b (1) ^b	ns
SIAS (M, SD) ^c	43.4 (8.8)	12.3 (4.9)	23.85 ^a (111) ^a	<.001

^a Independent samples t -test (df).

^b chi square.

^c Social Interaction Anxiety Scale total score.

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