



Contents lists available at ScienceDirect

# Personality and Individual Differences

journal homepage: [www.elsevier.com/locate/paid](http://www.elsevier.com/locate/paid)

## The effects of money exposure on testosterone and risk-taking, and the moderating role of narcissism<sup>☆</sup>

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### ARTICLE INFO

#### Keywords:

Money  
Testosterone  
Narcissism  
Risk-taking

### ABSTRACT

Although prior research has demonstrated that reminders of money influence motivations and behaviors, there has been scant attention to whether money cues can alter physiological responses. An experiment testing male participants assessed whether being randomly assigned to handle money versus paper would change men's testosterone levels and affect financial risk-taking. Results showed that the effects of handling money on testosterone levels and risk-taking depended on trait narcissism. Among men low in narcissism, handling money led to a greater increase in testosterone levels from Time 1 (baseline) to Time 2 (post-manipulation) compared with their counterparts in a neutral, non-money condition. Conversely, highly narcissistic men who were randomly assigned to handle money exhibited a weaker increase in testosterone levels relative to men in the neutral condition. The results of moderated mediation analyses suggested that money exposure affected financial risk-taking through changes in testosterone levels. Men low in narcissism became more inclined to take risks through an increase in testosterone levels, whereas men high in narcissism became more risk averse via a decrease in testosterone levels.

### 1. Introduction

Prior research has established that reminders of money can affect motivation, thought, and behavior (Vohs, 2015). For instance, thoughts of money decrease prosocial behavior (Gasiorowska, Chaplin, Zaleskiewicz, Wygrab, & Vohs, 2016; Vohs, Mead, & Goode, 2006) and increase task performance (Boucher & Kofos, 2012; Gasiorowska et al., 2016). Handling money renders people relatively impervious to social exclusion and physical pain (Zhou, Vohs, & Baumeister, 2009).

The current work sought to test potential physiological changes associated with being reminded of money in order to potentially help account for behavioral findings. Via random assignment to condition, some participants handled a large amount of money, whereas others handled slips of paper. Our main goal was to assess the effects of handling money on changes in testosterone levels and a decision making correlate of testosterone, risk-taking.

According to the Tool Theory of money motivation, money's psychological effects derive from its utility to achieve goals such as status ascension (Kniffin, 2006; Lea & Webley, 2006). Drawing from Tool Theory, we posit that handling money will elicit an increase in

testosterone levels, a hormone that has long been associated with status (Archer, 2006; Geniole, Bird, Ruddick, & Carré, 2017; Mazur & Booth, 1998; Zilioli & Bird, 2017). Testosterone levels have been shown to rise after engaging in conspicuous consumption (Saad & Vongas, 2009) and after winning (versus losing) in a variety of competitions including athletics (Booth, Shelley, Mazur, Tharp, & Kittok, 1989), video games (Carré, Campbell, Lozoya, Goetz, & Welker, 2013; Zilioli & Watson, 2012), and games of chance (Apicella, Dreber, & Mollerstrom, 2014; McCaul, Gladue, & Joppa, 1992; see Zilioli & Bird, 2017, for a review). Given that money can serve as a means of achieving status, and that testosterone levels are positively associated with social status, we expect handling money will result in a rise in testosterone levels.

Testosterone's links to status dovetail with an individual difference in the desire for status, trait narcissism, which we measured as a way to assess the status implications of handling money. Narcissism is characterized by the motivation to self-enhance and gain recognition and admiration by identifying and optimizing self-presentation events in one's social environment (Pincus et al., 2009). In response to an aggression solicitation paradigm, narcissism predicts a greater rise in testosterone levels and more aggressive behavior in the form of white

<sup>☆</sup> This research was supported by a Rike Consumer Research Foundation Research Grant from Wright State University. The first author acknowledges the support he received from his Richard T. Farmer Endowed Assistant Professorship and research grants from the Farmer School of Business, the Department of Marketing, and Miami University.

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<https://doi.org/10.1016/j.paid.2017.10.035>

Received 12 July 2017; Received in revised form 25 October 2017; Accepted 26 October 2017

Available online 15 November 2017

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noise blasts directed at an ostensible opponent of a reaction-time game (Lobbestael, Baumeister, Fiebig, & Eckel, 2014).

The literature seems to point to two ways in which narcissism might impact how testosterone levels change in response to handling money. On one hand, some research suggests that handling money could lead to a greater testosterone increase among narcissists compared to non-narcissistic people. Narcissists are focused on their social rank and seek opportunities to improve their rank through enhanced self-presentation (Marshall, Lefringhausen, & Ferenczi, 2015; Sorokowski et al., 2015; Weiser, 2015) and devaluing others (Krizan & Bushman, 2011; Pincus et al., 2009). In romantic relationships, narcissists are more likely to pursue short-term mating strategies (Schmitt et al., 2017), to seek admiration rather than intimacy, and to target romantic partners whose beauty or social rank can enhance their status (Campbell, 1999). Considering that narcissists are highly motivated by status concerns, one might expect that handling large amounts of money will lead to a greater increase in status and testosterone levels among highly narcissistic men relative to those low in narcissism.

On the other hand, some literature suggests that handling money could result in a decrease in testosterone levels among highly narcissistic men. Narcissists have a grandiose self-concept (Morf & Rhodewalt, 2001) and tend to be overconfident (Campbell, Goodie, & Foster, 2004). However, their grandiose ego is coupled with a highly vulnerable and fragile self-concept, producing a constant search for external affirmation (Morf & Rhodewalt, 2001). Narcissists' quest for status and admiration leads to a tendency to make frequent social comparisons (Krizan & Bushman, 2011). Compared to those low in narcissism, highly narcissistic people respond negatively to upward social comparisons (Bogart, Benotsch, & Pavlovic, 2004; Nicholls & Stukas, 2011). Narcissists who were instructed to handle large amounts of money might be inclined to mentally simulate what it would be like to possess that money and compare it to their current access to money or wealth. This comparison may act like a threat and engender a decrease in testosterone levels. Given this mixed literature, we took an exploratory approach and remained agnostic towards how narcissism might influence the effect of money on testosterone levels.

We assessed a form of decision making associated with status, narcissism, and testosterone, namely risk-taking. Narcissism has been shown to be predictive of greater risk-taking (Campbell et al., 2004) and gambling behavior (Lahey, Rose, Campbell, & Goodie, 2008). There is also considerable evidence suggesting that testosterone levels are positively associated with risk-taking. Although some research has found no association between testosterone and risk-taking (Derntl, Pintzinger, Kryspin-Exner, & Schöpf, 2014; Zethraeus et al., 2009) or a non-linear association between these two factors (Stanton, Mullette-Gillman, et al., 2011), many studies have revealed a positive relationship between risk-taking and various indicators of testosterone, from prenatal to circulating (Apicella et al., 2008; Apicella et al., 2014; Stanton, Liening, & Schultheiss, 2011; Stenstrom, Saad, Nepomuceno, & Mendenhall, 2011; van Honk et al., 2004). Based on this literature, we expected that testosterone changes elicited by money exposure would likely be positively associated with risk-taking.

An experiment tested how handling money, versus slips of paper (as a non-money cue), impacts testosterone levels and subsequent risk-taking, potentially as a function of trait narcissism. We assessed testosterone levels before and after a money exposure manipulation. Testosterone levels in men are generally more responsive to situational factors than are women's (Mazur & Booth, 1998; see Geniole et al., 2017, for a meta-analysis), and therefore we tested only men. Money exposure was manipulated by having participants either handle \$1600, a large amount of currency (money condition), or bill-sized slips of paper (neutral condition; Supplement S1).

## 2. Method

### 2.1. Participants and procedure

One hundred and nine men participated in exchange for a \$15 Amazon gift card and a chance to win additional money via a decision making task. We followed standard salivary testosterone collection procedures (as recommended by Schultheiss & Stanton, 2009, Zilioli & Watson, 2014, Blascovich, Vanman, Mendes, & Dickerson, 2011, and the Salimetrics lab that analyzed our saliva samples). After excluding two participants for reporting an oral disease (Zilioli & Watson, 2014), two for an insufficient amount of saliva which prevented testosterone assaying, and one for not correctly completing the risk-taking task (who selected not one but both of the options, rendering it impossible to calculate a total score), the final sample consisted of 104 participants ( $M_{age} = 20.63$ ,  $SD_{age} = 2.39$ ).

Data collection took place twice, at the end of the spring and fall 2015 semesters. During the fall session we added a third condition wherein participants handled small amounts of money (40 \$1 bills), which falls outside of the scope of the current manuscript and is reported in the Supplementary Materials (the procedure and results are reported in Supplements S2 and S3, respectively). It should be noted that we had intended to report the two data collections as two experiments. Given that they used the same procedures and tasks, we opted to report them as one study in order to conduct higher powered analyses and gain more accurate estimates (Cumming, 2013).

Participants were instructed to refrain from eating, drinking (except for water), or using nicotine for one hour prior to the scheduled start of the experiment (Zilioli & Watson, 2014). Sessions were conducted between 11:50 am and 5:30 pm. Upon arrival, participants were asked by the experimenter when they had last eaten, drank, and consumed nicotine in order to confirm that they had followed the fasting instructions.

Next, students were asked to watch 10 min of relaxing nature videos to induce a calm state. Participants were then instructed by the experimenter to rinse their mouths with water three times before watching another 10 min of calming videos. They were subsequently asked to passively drool approximately 1.0 ml of saliva into a polypropylene vial using a Salimetrics saliva collection aid to measure pre-manipulation testosterone levels. Saliva samples were immediately stored in a freezer at  $-20^{\circ}\text{C}$ .

Following the saliva sampling, participants were randomly assigned to a money condition (a sorting task with 80 \$20 bills) or a neutral condition (sorting 80 plain pieces of paper with the same size dimensions as \$20 bills; Zhou et al., 2009; Supplement S1) in a between-subjects design (see Supplement S4 for sorting task details).

Participants subsequently completed a financial risk-taking task with real monetary outcomes (Holt & Laury, 2002; Supplement S5). They were presented with 10 lotteries, each with a safer option and a riskier option. The number of risky options chosen was our measure of risk-taking (0 to 10).

Fifteen minutes after the sorting task, a second saliva sample was taken (Mehta & Josephs, 2006). We then measured narcissism using a reduced 28-item version of the Pathological Narcissism Inventory (Pincus et al., 2009; Supplement S6). Responses were given on a 5-point scale (1 = strongly disagree, 5 = strongly agree) and scores were averaged ( $\alpha = 0.89$ ). Next, we measured the number of alcoholic drinks consumed within the last 12 h, the number of caffeinated beverages consumed that day, how much time they exercised that day, and the number of nicotine products used that day (van Anders & Goldey, 2010; Zilioli & Watson, 2014). We also collected basic demographic information. Last, participants were given their earnings from the risk-taking task.

Saliva samples were packaged with dry ice and shipped overnight to Salimetrics (Carlsbad, CA) for analysis. There, each sample was assayed, in duplicate, using a sensitive enzyme immunoassay for

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