Personality and Individual Differences 86 (2015) 344–347

Contents lists available at ScienceDirect

Personality and Individual Differences

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

Review

Changes in intertemporal choices in deviant behaviors☆

Diana Moreira [a,b,*], Susana Barros [a], Fernando Almeida [b], Marta Pinto [b], Fernando Barbosa [a]

[a] Laboratory of Neuropsychophysiology, Faculty of Psychology and Educational Sciences, University of Porto, Portugal
[b] Social and Behavioral Sciences Department, Maia University Institute, Portugal

ARTICLE INFO

Article history:
Received 10 January 2015
Received in revised form 25 June 2015
Accepted 27 June 2015
Available online 8 July 2015

Keywords:
Delay discounting
Impulsive behavior
Immediate consequences
Delayed consequences

ABSTRACT

Delay discounting is the process of devaluing results that happen in the future. We present a comprehensive literature review of changes on intertemporal choices in deviant behaviors, namely in (a) substance-related and addictive disorders, (b) disruptive, impulse-control, and conduct disorders, and (c) eating disorders. We also present studies focused on differences in demographic characteristics of the populations by gender, age, and education/social class. Delay discounting is presented as a process of studying intertemporal choices, resulting from decades of empirical research. Studies indicate that this process may provide explanation as to why individuals will sometimes choose a smaller reward, available sooner, instead of a larger reward available later. When studying populations with the above-mentioned problems, they tend to exhibit more pronounced discounting functions than control groups. The association between discounting and gender is not clear. The relationship between delay discounting and age is relatively clear, where older individuals discount less markedly than younger individuals. Studies suggest that shallower discounting gradients are associated with higher levels of intelligence and academic success. We emphasize the need for more empirical research on delay discounting, especially in regard to deviant behavior that may be associated with impulse-control disorders.

1. Introduction

Intertemporal choices are defined as choices that involve exchanges between costs and benefits that occur at different points in time (Johnson, 2012; Pimentel, Gonçalves, Scholten, Carvalho, & Correia, 2012). There has been increasing interest in delay discounting, i.e., the process of devaluing results that happen in the future (e.g., Ainslie, 1974; Green & Myerson, 2004; Logue, 1988; Rachlin & Green, 1972), as a means to study intertemporal choices. This process may be used to explain the observation in which individuals will sometimes choose a smaller reward, available sooner, instead of a larger reward available later on (Kim & Lee, 2011). It was thought that immediate choices were impulsive or hasty because the wait would result in a larger reward. Given the link between delay discounting and impulsive behavior, it is not surprising that part of the interest in delay discounting is driven by the growing literature that links high levels of discount and presumably a high aversion to delay (meaning preference for immediate gratification even if of smaller value), to a number of psychiatric diagnoses, for example, drug addiction, attention deficit hyperactivity disorder, and schizophrenia (for review, see Madden & Bickel, 2010).

Impulsivity can operate as a moderating variable between the choice and the obtained reward. Impulsivity refers to a difficulty of self-control, which may be manifested in the daily routine in several ways, for instance: extraversion, impatience, inattention, neglect, engagement in risk situations, search for new experiences and sensations, depleted insight on injury (Hollander & Evers, 2001). This is a symptom in several mental health conditions directly associated with impulse control disorders, such as (a) substance-related and addictive disorders, (b) disruptive, impulse-control, and conduct disorders, and (c) eating disorders (APA, 2013). Thus, it is important to review the empirical research regarding delay discounting alterations in such mental-health conditions.

2. Delay discounting in substance-related and addictive disorders

A large number of studies have indicated that individuals who are addicted to drugs of abuse (e.g., nicotine, alcohol, cocaine, methamphetamines) usually discount delay rewards more markedly than individuals without an addiction (Bickel & Johnson, 2003; Heil, Johnson, Higgins, & Bickel, 2006; Hoffman et al., 2006; Landes, Christensen, & Bickel, 2012; Reynolds, 2006; Yi, Mitchell, & Bickel, 2010). This difference in discounting extends to heavy non-addicted users compared to light non-addicted users, and to individuals who use a wider variety of illicit substances compared to those who use fewer substances (Kollins, 2003; Mitchell, 2003).

Specifically regarding alcohol, its addiction is associated not only with impulsive choices, but also to an inability to defer large rewards

☆ The authors do not have any interests that might be interpreted as influencing the research. The study was conducted according to APA ethical standards.

* Corresponding author at: Faculty of Psychology and Educational Sciences, University of Porto, Rua Alfredo Allen, 4200-135, Porto, Portugal.
E-mail address: dianapmoreira@gmail.com (D. Moreira).

http://dx.doi.org/10.1016/j.paid.2015.06.046
0191-8869/

in time (Klingemann, 2001). These data were also supported by a neuroimaging study by Claus, Kiehl, and Hutchison (2011), which compared a group of social drinkers and another with severe addiction (using fMRI). Individuals with more severe drinking problems evidenced an increased discount on delayed rewards, as well as higher activation of certain brain areas (e.g., insula, orbitofrontal cortex, inferior frontal gyrus, and precuneous), suggesting an association between impulsive choices in these individuals and dysfunctions in those areas.

With regard to non-substance addictions, pathological gambling is often elected as a model for the study of behavioral addiction. Existing studies generally aid the conclusion that pathological gamblers tend to discount delay rewards more markedly than controls (Bickel & Marsch, 2001; Bickel, Odum, & Madden, 1999; Conversano et al., 2012; MacKillop, Anderson, Castelda, Mattson, & Donovick, 2006; Monterosso & Ainslie, 2007; Petry, 2001; Petry & Madden, 2010; Vuchinich & Simpson, 1998), just as those addicted to drugs of abuse do. However, studies that systematically examine the performance of pathological gamblers in delay discounting tasks are, unfortunately, missing. This may be partly due to difficulties in the diagnosis of this disorder, as pointed out by Petry and Madden (2010).

3. Delay discounting in disruptive, impulse-control, and conduct disorders

Delay discounting was related to the tendency to engage in more risky behavior. For example, heroin addicts who reported sharing needles and, thus, increasing their risk of contracting HIV or hepatitis C, showed more marked discounting functions than those who did not (Odum, Madden, Badger, & Bickel, 2000).

Regarding conduct disorders, compared with healthy youths, youths with conduct disorders chose significantly smaller amounts of immediate reward rather than the larger future rewards (White et al., 2014).

Krueger, Caspi, Moffitt, White, and Stouthamer-Loeber (1996) found that 13-year-old boys who showed signs of aggression disorders and delinquency tend to seek instant gratification in a laboratory task, implying a more pronounced discount of delayed rewards, more often than boys without these disorders or boys who displayed signs of internal disorders (anxiety and depression). However, Wilson and Daly (2006) found that juvenile offenders (12–19 years of age) were not significantly different from non-offenders in future discounting using a task in which individuals chose between monetary rewards available "tomorrow" versus rewards available later on (extent: 7–162 days).

Antisocial personality seems also to interact with substance abuse and other risk behaviors in determining delay discounting. For example, smokers with low psychopathy ratings were more likely to discount delayed rewards (i.e., more impulsively) than nonsmokers, whereas smokers with high psychopathy ratings did not differ from nonsmokers (Melanko, Leraas, Collins, Fields, & Reynolds, 2009). Substance abusers with antisocial personality disorder (APD) also discounted delayed rewards at higher rates than their non-APD substance-abusing counterparts (Petry, 2002).

In summary, the delay discounting patterns of individuals showing risky behaviors seem to be similar to the ones of substance users and other conditions associated with impulse-control disorders.

4. Delay discounting in eating disorders

The link between dysregulated eating behaviors and delay discounting was made on several occasions and, in fact, initial studies that analyzed the phenomenon focused on decisions between eating desirable food/drinks instead of waiting for more food/drinks later on (e.g., Forzano & Logue, 1994; Logue & King, 1991). The most pronounced delay discounting was associated with obesity in women (Weller, Cook, Avsar, & Cox, 2008), higher percentage of body fat (Rasmussen, Lawyer, & Reilly, 2010), and increased body mass index (Borghans & Golsteyn, 2006; Manwaring, Green, Myerson, Strube, & Wilfley, 2011; Rasmussen et al., 2010; Smith, Bogin, & Bishai, 2005; Zhang & Rashad, 2008). In general, the literature is consistent with the thesis that obesity is associated with more accentuated delay discounting.

5. Differences in demographic characteristics of the populations

5.1. Gender

A meta-analysis of 33 studies by Silverman (2003) found that women discounted delayed rewards less markedly than men. However, gender effects were small and detectable only by some measures of delay discounting (Silverman, 2003), and other studies found no systematic gender differences (e.g., Fingerman & Perlmutter, 1995). Notably, female advantages seem to be larger when continuous measures (time waited to reward) rather than dichotomous measures (choices between small vs. larger rewards) are used (Silverman, 2003). Thus, the association between discounting and gender is not clear and seems to be dependent on methodological options.

5.2. Age

Several studies used transversal designs to analyze whether there are systematic differences in delay discounting as a function of age. These studies used samples with age groups ranging from 12 to 75 years of age and generally indicated that discounting decreases throughout life (Green, Fry, & Myerson, 1994; Harrison, Lau, & Williams, 2002), which may point to a tendency of life development toward increasing self-control. It is noteworthy that in the study by Green et al. (1994), a single function with age-sensitive parameters adequately described the discounting curves of all age groups, suggesting that although there were quantitative age differences in delay discounting, the process of choosing between rewards of different quantity and delay is qualitatively similar throughout life. In a younger sample, with participants ranging between 10 and 30 years of age, Steinberg et al. (2009) also found quantitative age differences, not qualitative, in functions of delay discounting. However, they noticed that delay discounting decreased only until 16 years of age, after which it remained stable (Steinberg et al., 2009).

A recent study by Banich et al. (2013) examined the neural systems activated during the process of intertemporal choices and its association with non-immediate thinking (NIT), in two groups of adolescents (one group in the initial phase of adolescence, between the ages of 14 and 16, and another at the final phase of adolescence, from 17 to 19 years old). They observed different patterns of brain activity in immediate vs. future choices involving three distinct brain systems, namely, cognitive control (inferior/middle/superior frontal gyrus and lateral frontal pole), evaluation (brain stem and ventral tegmental area), and prospection (parahippocampal gyrus). Activity in these systems becomes even more differentiated with age in regard to immediate vs. delayed choices, as well as in relation to NIT. Differences of activation that were found in brain systems especially involved in cognitive control, demonstrate the complex interaction of developmental and individual differences regarding such control, and its importance in immediate vs. delayed choices.

In summary, the relationship between the delay discounting gradient and age is relatively clear, where older individuals discount less markedly than younger individuals.

5.3. Education and socio-cultural variables

There is evidence from several studies that the discounting rate for real, delayed monetary rewards is negatively correlated with GPA (grade point average) in college students (e.g., lower discounting rates are correlated with higher GPA) and the relationship remains robust