



Impulsivity, Shortsighted Decisions, and Discounting

A Review of

Impulsivity: The Behavioral and Neurological Science of Discounting

by Gregory J. Madden and Warren K. Bickel (Eds.)

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Ever since the ancient Greek civilization started to ponder behavior, it has been assumed that humans are rational and consciously reason through decisions. Despite assumptions about rationality, human behavior is plagued by shortsightedness and is often impulsive. Why do otherwise rational people have poor eating habits, gamble, overspend, engage in promiscuity, and have numerous other behaviors that may have very negative long-term consequences?

To begin to understand the magnitude and cost to our society of impulsive behavior, one need only look at some behavioral statistics regarding maladaptive behaviors. The average American family has a variety of problem behaviors, including credit card debt (\$9,000), weight and diet issues (two thirds of Americans are overweight or obese), and addictions (high prevalence and relapse rates for alcoholism, substance abuse, and gambling). Significant delay discounting is common in heavy alcohol consumption and gambling (Petry, 2001a, 2001b). Moreover, many crimes can be considered impulse driven as well. Madden and Bickel's edited book *Impulsivity: The Behavioral and Neurological Science of Discounting* covers these aforementioned topics in great detail.

Specifically, Chapters 7 and 9 describe how delay discounting relates to alcoholism and substance abuse, including nicotine, opioid, cocaine, and methamphetamine use. Chapter 10 describes numerous aspects of discounting, including discounting curves and how they relate to pathological gambling. These otherwise perplexing behaviors are described and defined in objectively measureable ways that help the reader understand the underlying cognitive issues that maintain these problem behaviors.

Impulsivity is mentioned in the diagnostic criteria of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV;* American Psychiatric Association, 1994) as prominent in several psychiatric disorders. It is a key aspect of mania and personality and conduct disorders, and is also regarded as the most relevant symptom in attention-deficit/hyperactivity disorder (ADHD; Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001; Volkow & Fowler, 2000).

Though some people may have a *DSM-IV*-diagnosable disorder that affects impulse control, most people have situational impulsivity, which may not be diagnosable but clearly may be ubiquitous and carry significant risks and consequences. *Impulsivity*, particularly Chapter 12, helps the reader understand how impulsivity and discounting relate to ADHD.

The concept of impulsivity covers a wide range of "actions that are poorly conceived, prematurely expressed, unduly risky, or inappropriate to the situation and that often result in undesirable consequences" (Daruna & Barnes, 1993, p. 23). When one is thinking about impulsivity, it is essential to understand its multidimensional nature and its cognitive subcomponents. There may be many ways to conceptualize impulsive behavior; however, there is often little discussion of the cognitive processes that contribute to these behaviors.

Many poorly reasoned decisions and impulsive or shortsighted behaviors often involve a complex underlying perceptual distortion called *delay discounting*. Delay discounting is a reasoning process whereby when considering an immediate behavior, a person minimizes the long-term risks or benefits associated with that decision. It is a decrease in the subjective value of a reinforcer (i.e., money, drugs) as a function of time to its delivery. In many studies of delay discounting, the value of a smaller yet more immediate outcome is changed as the value of a larger but more delayed outcome is held constant. Impulsive behaviors occur when individuals choose smaller yet more immediate rewards in a manner that may substantially reduce long-term rewards or when the individual minimizes the possible long-term risks.

There is also a point, called the *indifference point*, when participants prefer neither the smaller but immediate nor larger but later outcome. The indifference point is a measure of how deeply a person is discounting the delayed outcomes. Discounting rates in humans have been found to change both with size of rewards offered (e.g., \$1,000 to \$10,000; Kirby, 1997) and with substance (e.g., food vs. money; Estle, Green, Myerson, & Holt, 2007), and different methods of determining the degree of delay discounting have been found to yield similar results.

The discounting process is a powerful bias that ultimately causes us to make shortsighted decisions and perhaps works against self-protective cognitive biases we typically exhibit, such as loss aversion (negativity bias), in which negative outcomes are more salient or powerful than good outcomes. That bias pushes us to reduce risks. Predicting delay discounting could therefore serve a useful purpose in understanding impulsive behaviors and developing effective treatment for those behaviors, which have not yet been very effectively treated.

Impulsivity, Delay Discounting: State Versus Trait

Impulsivity has long been conceptualized as an aspect of personality (Patton, Stanford, & Barratt, 1995), as a conflict between parts of personality such as between the id and ego, or as a seeking to fulfill subconscious psychological needs. Some behavioral research suggests that behavior is based on response contingencies or that people simply act in ways that are reinforced. Among the predictors of human behavior are not just traits, culture, emotional states, and situational variables, but also perceptual and subconscious cognitive patterns. Some research has sought to explain behavior through a variety of demographic variables, some of which do reasonably well in explaining behavior.

Chapter 2 in *Impulsivity* does an excellent job of reviewing the research on traits and demographic variables that affect discounting. This chapter presents research that suggests that gender is generally not a significant contributor to degree of delay discounting, though some studies suggest that men may discount hypothetical money more than women do.

Delay discounting is affected by income and educational level, and some research (Green, Myerson, Lichtman, Rosen, & Fry, 1996) has found that individuals with higher incomes (more than \$40,000) discounted money less steeply than did participants with much lower incomes (less than \$10,000). Studies on education suggest that the degree of discounting negatively correlates with years of education (de Wit, Flory, Acheson, McCloskey, & Manuck, 2007) and grade point average (Kirby, Winston, & Santiesteban, 2005). Economists have long recognized the discounting of delayed outcomes as an important barrier to humans' ability to maximize their resources.

When one is considering issues such as impulsivity and discounting, it is clear that there are negative aspects to these behaviors, yet some might ask why a behavior would persist and be so pervasive if it is entirely maladaptive. For example, there may be a benefit to choosing a smaller, sooner reward rather than waiting, and this is exemplified in statements like "A bird in the hand is better than two in the bush." Some of the ADHD literature clearly suggests that there may be some environments where momentary attention to the most salient stimulus is most adaptive and perhaps was once adaptive by evolutionary standards. Chapter 13 of Madden and Bickel's book reviews the possible benefits of impulsive behavior.

Impulsivity and the Brain

It is unclear whether a single neurological system underlies discounting, whether this process invokes disparate systems,

or whether different systems come into play in different types of impulsive behavior and discounting. Though it may be futile to try to localize such a dynamic function, damage to or dysfunction of the prefrontal cortex, and more specifically the orbitofrontal cortex, is related to impulse control difficulties (Torregrossa, Quinn, & Taylor, 2008). Olson et al. (2009), using diffusion tensor imaging with children and young adults, found that delay discounting strongly relates to cerebral dysfunction in the prefrontal cortex.

The striatum, with its high connectivity with the prefrontal cortex, also contributes to several forms of impulsive behavior (Torregrossa et al., 2008). Winstanley, in Chapter 4, provides empirical support indicating that aspects of the medial prefrontal cortex and parts of the corticostriatal loop play a role in reward behavior and delay discounting. There is also an enormous amount of research linking impulsivity with neurotransmitters.

One might ask whether it is too reductionist to discuss such a complex construct as impulsivity as the result of some neurotransmitter imbalance or a neuronal firing imbalance. Empirical research provides reasonably strong evidence that the dopaminergic and neuroadrenaline systems in limbic or central executive structures are centrally involved in impulse control (Pattij & Vanderschuren, 2008). In addition, several studies have suggested, albeit with mixed evidence, that serotonin may be involved in discounting as well. A study (Tanaka et al., 2007) indicated that changing the levels of serotonin precursors (e.g., tryptophan) can change the measured discounting rates in human participants.

Impulsivity: A Provocative Read

Most of us have made shortsighted decisions or at the very least have some unhealthy habits that we may find some way to rationalize. Conversely, we may wonder why we continue to engage in these behaviors. Though we may assume that these decisions are devoid of thought, the aforementioned literature strongly suggests that discounting thought processes may be a cause.

Anyone with an intellectual curiosity about decision making and behavior would benefit from reading *Impulsivity*. It takes a complex cognitive construct and provides a translation research approach that covers a broad range of perspectives on discounting. Chapter 7 of this text does a spectacular job of describing how discounting relates to substance abuse and dependence. Chapter 11, which examines the role of delay discounting in health decision making, should interest everyone and shows that discounting significantly affects individual health decisions as well as health policy decision making.

For students of psychology, economics, substance abuse, and neuroscience, this book (or at least some of its chapters) is a must read in order to gain a greater understanding of these behavioral domains. It is likely that many people who work in addictions research and treatment would benefit from reading this book, and it may spawn new ideas about addictions treatment.

Though *Impulsivity* is well written and edited, flows well, and provides an excellent review of considerable empirical research to support the pervasiveness of discounting, it is an effortful read. It is a book that should earn a place on the reading list of many social science classes because it helps one get past superficial labels for impulsive people and behaviors and helps promote understanding. For instructors and professors of all ranks, this text and topic warrant detailed discussion.

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