The effects of potentially real and hypothetical rewards on effort discounting in a student sample

Marta Malesza

Department of Psychology, University of Potsdam, Karl-Liebknecht-Str. 24-25, 14476 Potsdam, Germany.

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ABSTRACT

The primary aim of the present study was to investigate the functional form of discounting of monetary rewards by physical effort in potentially real and hypothetical contexts. Individuals (N = 142) completed the assessments with hypothetical and potentially real effort discounting tasks, and their hypothetical or potentially real consequences. The data obtained from the experiment reported here suggest that hypothetical conditions yield patterns of discounting that mirror those for potentially real effort tasks and outcomes. However, this finding also leaves open the possibility that the degree of discounting may change together with the repeated exposure to the consequences of decisions, or the counterbalanced order of hypothetical and potentially real tasks.

1. Introduction

Discounting refers to a decrease in the subjective value of an outcome as a specific environmental factor on which a reward or a loss is devalued increases (e.g., Rachlin, 2006; Rachlin, Raineri, & Cross, 1991). The most widely studied process, delay discounting (see Madden & Bickel, 2010) typically refers to the preference for smaller immediate rewards over larger but delayed rewards. The value of the larger reward is said to have been discounted. Of course, the value of a reward decreases as a function of variables other than time. Apart from the discounting of delayed rewards, behavioural psychology also studies effort discounting (the decrease in subjective value of the gain coinciding with the increasing effort needed to gain the reward, see Mitchell, 1999, 2004; Sugiwaka & Okouchi, 2004). In behavioural psychology, clinical applications are seen in cases of effort-discounting procedures, particularly with respect to aberrant motivational states in neurological disorders and depression (Hartmann, Hager, Tobler, & Kaiser, 2013). For example, apathetic patients show a reduction in motivation and less goal-directed behaviour. Given the increased interest in precisely measuring the degree of effort discounting, either across specific sub-populations (e.g., cigarette smokers vs. non-smoking individuals, see, e.g., Mitchell, 1999), or across stages of treatment (e.g., as a measure of the efficacy of treatment, see, e.g., Gold et al. (2013)), it is important to determine whether current procedures for assessing human effort discounting are valid.

1.1. Hypothetical and potentially real discounting tasks

In the typical effort discounting procedure, individuals make a series of forced-choice decisions regarding preference for a relatively small outcome available without any effort, and a larger outcome available after making a specified effortful task. For example, given a choice between €5 available effortlessly and €80 available after swimming two lengths of a pool, most people choose the effortful outcome. However, as the effortless amount is increased in subsequent questions, most participants eventually “switch” their preference from the larger effortful outcome to the smaller effortless outcome (e.g., at an effortless amount of €60). The point at which the individual switches represents the subjective value of the large reward for that effort (Sugiwaka & Okouchi, 2004). This process is repeated across several effort conditions and this results in a discounting pattern in which the subjective value of the large reward diminishes as the effort required gaining the reward increases (Ostaszewski, Bąbel, & Swebodziński, 2013).

Using hypothetical discounting tasks circumvents problems with increased prohibitive costs associated with conducting discounting research and delivering some outcomes based on individual choices (Lawyer, Schoepflin, Green, & Jenks, 2011; Madden, Begotka, Raiff, & Kastern, 2003). If time is limited, using hypothetical discounting procedures can save time. Multiple prospect choices may be assessed within a single session, thereby allowing the participants to answer several hundred questions in a typical discounting task. Thus, the researcher is able to quickly determine the degree of the discounting rate. Moreover, the use of real rewards significantly limits the magnitude of
rewards (e.g., €10,000) and the size of effort conditions task (e.g., 100 floors) required to get the reward. As a result, this makes the reward delivery unethical or unfeasible (Lawyer et al., 2011). Finally, hypothetical effort tasks and hypothetical rewards are often used to avoid these logistical challenges, and participants are instructed to respond as if the choices were real (Madden et al., 2003, 2004). However, one concern associated with the use of hypothetical conditions in discounting research is that the decisions the individual makes for hypothetical conditions may not be synonymous with the same decisions made for real ones (Madden et al., 2004). Obviously, every researcher who has used hypothetical rewards has questioned the validity of their procedures, noting that choices made between these outcomes may not accurately reflect the choices between real outcomes. This is why researchers have directly compared real and hypothetical outcomes with the discounting paradigm to answer the question of outcome equivalence with internally valid procedures (Baker, Johnson, & Bickel, 2003; Kirby, 1997; Lawyer et al., 2011; Madden et al., 2003, 2004). These comparisons have typically been conducted in one of two ways (see Lawyer et al., 2011). Some researchers deliver a reward for each choice the participant makes (i.e., real outcomes). This method, used less frequently, offers a clear comparison between real and hypothetical outcomes but limits the size of the outcomes and discounting factors used for feasibility and ethical reasons. Second, in other studies researchers use a lottery-based system in which participants experience the consequences of one choice trial that is randomly selected from all trials (i.e., potentially real outcomes). The assumption in this procedure is that each decision will be for functionally real outcomes because each choice has an equal chance of being selected at the end of the experiment, and participants should, in theory, behave as though each selected outcome was real. Given the increased interest in the precise measurement of the degree of the discounting rate, and addressing concerns that individuals may respond differently in potentially real and hypothetical effort discounting procedures, evaluating the validity of current procedures for assessing effort discounting appears very important. Research examining the empirical differences between potentially real and hypothetical conditions in delay discounting has repeatedly found that two different outcomes generate similar data (Baker et al., 2003; Madden et al., 2003; see Kirby (1997), for contradictory results).

Mitchell (2004) used in her study real monetary rewards and real effort requirements. If participants had indicated a preference for the effortful reward ($10), they were required to squeeze the hand dynamometer for 5 s before they were given $10. Unfortunately, the investigation used small monetary amount, and was done on a small sample ($n = 11$; Mitchell, 2004). Using a larger sample size allowed us greater statistical power to detect an effect of reward type (Madden et al., 2003). Also, the study by Mitchell (2004) did not compare real and hypothetical effort tasks during the effort discounting measures process together with real and hypothetical rewards. Thus, provided empirical evidence does not allow drawing firm conclusions about the difference in discounting rates of real and hypothetical effortful rewards.

As a consequence, the present study sought to further explore the relationship between the reward type and the rates of effort discounting by the use of within-subjects comparison method. Here the author compares potentially real effort tasks together with potentially real consequences and hypothetical effort tasks together with hypothetical rewards. Physical effort was operationalized as the number of floors the individual had to climb. Participants repeatedly chose between an effortless/low reward and an effortful/high reward option. In the latter, both the physical effort (number of floors) and the monetary reward magnitude were independently manipulated.

2. Methods and materials

Participation was completed over the course of three visits, consisting of an informed consent session and two experimental sessions. All three sessions were completed at the intervals of one week. On their arrival at the laboratory, participants provided informed consent for their participation in the study and for the release of their test scores for research purposes. During the informed consent session, individuals were asked to complete the International Physical Activity Questionnaires. Next, during the following two experimental sessions each participant completed two discounting tasks—one with potentially real effort and rewards conditions, and one with purely hypothetical effort and outcomes conditions. Discounting tasks were programmed in z-Tree software (Zurich Toolbox for Readymade Economic Experiments). The order of task completion was counterbalanced across participants to control the order effect (i.e., half completed potentially real effort condition during the second study visit and hypothetical effort condition during the third visit; half completed hypothetical effort condition during the second study visit and potentially real effort condition during the third visit).

2.1. Participants

A total of 142 German university students participated in the experiment (ranging in age from 19 to 25 years, $M = 20.7$, $SD = 1.2$; 87 women). Individuals were recruited through posted advertisements at the local university. Inclusion criteria required having good physical health and having no history of psychological illness. Additionally, applicants should not meet dependence criteria for any substance abuse (smoking, alcohol drinking and using any illicit substances within the last year). Participants were screened on the basis of these criteria with the hope of providing a homogeneous sample of students that varied little in the degree of effort discounting. All subjects were offered feedback on general results of the study. The local Institutional Review Board approved the study.

2.2. Procedure

Before completing each discounting task, participants were given the following instructions (adapted from Madden et al. (2003)):

You are going to make some decisions regarding which of two rewards you would prefer. One of the rewards will be available without any effort and the other will only be available after you have done a specified physical task (climbing a specified number of floors). For example, I might ask you to choose between €10 delivered without any effort and €100 delivered after climbing 10 floors. The choices you make are completely up to you.

2.2.1. Hypothetical effort discounting task

A computerized procedure, developed for the purpose of studying hypothetical choice behaviour, was used for assessing the effort discounting paradigm (based on the procedure for delay discounting measures adapted from Richards, Zang, Mitchell, & de Wit (1999)). Discounting was assessed by five values of effort intervals (3rd, 10th, 15th, 20th, and 30th floor).

On each effort task trial, the choice was between an effortless amount of money or €100 available after putting in an effort (i.e., climbing stairs up to a specified floor: the 3rd, 10th, 15th, 20th, and 30th floor) (i.e., “Would you rather have €20 without doing anything or €100 after climbing 10 floors?”). This computerized task used the adjusting amount procedure (adjusting the effortless amount in increments or decrements of ± €5) to derive indifference points between the effortful standard and effortless adjusting options for each of the five floor numbers assessed. The effortless amount was determined by a random adjusting-amount procedure (Richards et al., 1999) involving random selection within a fixed interval that depended on the participant’s previous choices. If the smaller effortless reward is consistently preferred, then the larger effortful reward is made more attractive (by
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