Behavioural Processes 90 (2012) 424–427

Contents lists available at SciVerse ScienceDirect

Behavioural Processes

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

Short report

Discounting the freedom to choose: Implications for the paradox of choice

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ARTICLE INFO

Article history:
Received 5 December 2011
Received in revised form 14 February 2012
Accepted 27 March 2012

Keywords:
Choice
Choice overload
Discounting
Paradox of choice
Search costs

ABSTRACT

Organisms prefer to make their own choices. However, emerging research from behavioral decision making sciences has demonstrated that there are boundaries to the preference for choice. Specifically, many decision makers find an extensive array of choice options to be aversive, often leading to negative emotional states and poor behavioral outcomes. This study examined the degree to which human participants discounted hypothetical rewards that were (a) delayed, (b) probabilistic, and (c) chosen from a large array of options. The present results suggest that the "paradox of choice" effect may be explained within a discounting model for individual patterns of decision making.

As described by Catania, "Whatever else is involved in the concept of freedom, it at least involves the availability of alternatives" (p. 89; 1975). Thus, within a behavioral framework, *freedom* may be loosely conceptualized as the *ability to choose*. In Catania's seminal article – as well as two further replications (e.g., Catania, 1980; Catania and Sagvolden, 1980) – he supports this notion through experimental demonstrations that pigeons' responses in the initial links of concurrent-chain schedules indicated a preference for choice (as compared to a forced choice option), even when rate of reinforcement and the variety of schedule-correlated stimuli were controlled. Similar findings have been replicated with rats (e.g., Voss and Homzie, 1970) and monkeys (e.g., Suzuki, 1999), as well as humans in both laboratory (e.g., Brigham and Sherman, 1973) and applied (e.g., Tiger et al., 2006) settings.

The argument in favor of choice is intuitively appealing; the ability to choose is preferred, likely due to both ontogenic and phylogenic origins (Catania, 1975; Catania and Sagvolden, 1980; Iyengar, 2010). Despite such lore regarding the value of choosing, there appears to be paradoxical boundary conditions for the preference for choice. For example, in a follow up study to his 1975 article, Catania (1980) varied the number of terminal link free choice keys, but failed to show any increase in preference – as measured by initial link rates of responding – beyond that obtained when only two terminal link free choice keys were available. In another curious demonstration of the preference for choice, Hayes et al. (1981) documented pigeons' consistent initial link preference for constraint (i.e., no ability to choose) over free choice, despite amount of food obtainable being held constant across conditions.

While not extensively studied in behavior analysis, the differential effects of choice architecture on the preference for choosing have gained notoriety in social psychology and marketing research. Such research has identified negative effects of *too much* choice on effective decision making; this paradoxical phenomenon has subsequently been termed the "*paradox of choice*" (Schwartz, 2004). In particular, decision making researchers have found that increased numbers of choice options may result in poor behavioral outcomes, such as decrements in self-control, stamina, and executive functioning (Vohs et al., 2008), perhaps leading some humans to prefer *fewer* choice alternatives.

The paradox of choice phenomenon has traditionally been measured by comparing two groups; one who chose among small (few) and the other from large (extensive) numbers of options. In the seminal study on the paradox of choice by Iyengar and Lepper (2000), researchers presented either six or 24 jam varieties to customers shopping at a sampling booth in an upscale foods store. While more customers approached the booth displaying many samples, more purchases were made when fewer were presented. This finding has been replicated across numerous commodities, such as chocolates (Chernev, 2003; Iyengar and Lepper, 2000) and retirement plans (Iyengar et al., 2004).

Wieczorkowska and Burnstein (1999) propose that *search costs* may provide an explanation for this paradox of choice. The search cost hypothesis has origins in the animal foraging literature (e.g., Dallery and Baum, 1991; Krebs and Davies, 1997) and is operationalized as the time, risk, and effort associated with making a decision. For example, Dar-Nimrod et al. (2009) found

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0376-6357/$ – see front matter
http://dx.doi.org/10.1016/j.beproc.2012.03.017

that some humans were more likely to expend resources (e.g., spending more time completing paperwork or driving further distances) in order to choose from a larger number of options, yet these individuals subsequently reported less satisfaction with their decision. To date, no specific behavioral processes have been presented as possible explanations for this paradox of choice effect.

In a similar study, Reed et al. (2011) asked human participants to make repeated choices across progressively increasing numbers of options. This repeated decision task preparation was used to determine within-subject "breakpoints"; that is, the number of options at which participants would switch preference from more options to fewer. Results indicated that a majority of participants began to switch to limited-choice (i.e., participants preferred *fewer* options) when the many-choice option featured only six alternatives. Analyses of the aggregated data indicate that the percentage of participants choosing the many-choice option decreased in a hyperbolic-like discounting function as the size of the many-choice option increased.

Collectively, these finding suggest that the processes underlying the paradox of choice may have relations to discounting (i.e., decreases in the subjective value for rewards as the delay of, odds against, or effort required for their receipt increase). One interpretation of these findings is that preference for more choice may be discounted as a function of search costs (i.e., number of options), similar to effort discounting. From a translational perspective, this interpretation of the paradox of choice seems warranted given previous suggestions that the kinds of search costs associated with this phenomenon are time (cf. delay discounting), risk (cf. probability discounting), and effort (cf. effort discounting). What remains unanswered, however, is whether (a) such a discounting effect related to the paradox of choice is documented within-subject and (b) discounting of many options is related to either delay or probability discounting.

1. Method

Seventy-six undergraduates (60 females) enrolled in an introductory psychology course (ages ranged from 18.33 to 44.83 yr [M = 20.82 yr, SD = 3.16]) were recruited and received extra credit for participation. Groups of three to ten participants were tested in a quiet computer lab. Participants sat at individual computers and monitors during the 30 min session.

A computer administered adjusting amount discounting task was used to calculate participants' indifference points (i.e., the point at which both alternatives' subjective values are equal). The task used was equivalent to that employed by Du et al. (2002). In this task, participants were asked to make a series of choices between two hypothetical monetary options; one large option (always $1000; LR for "large reward") and the other small (an adjusting amount, always less than $1000; SR for "smaller reward"). The adjusting procedure consisted of six trials for each condition (i.e., value) of each discounting assessment. Within this procedure, choice of the SSR led to a 50% decrease in the amount SSR on the next trial. Contrarily, choice of the LLR led to a 50% increase in the amount of the SSR on the subsequent trial. The "subjective value" of the reward for each condition was calculated as the next SR value at the end of the sixth trial that would be predicted by the aforementioned titration procedure.

For the delay discounting assessment, the SR was always available immediately, while the LR was available after a delay. Delay values (i.e., delay conditions) consisted of .08 (1 month), .50, 1, 3, 5, and 10 years. For the probability discounting assessment, the SR was certain, while the LR was associated with a percent chance of receipt. The probabilities of receiving the larger reward (i.e., probability conditions) consisted of .95, .90, .70, .40, .10, and .05. These probabilities of receipt (p) were converted to "odds against" receipt (Θ) by subtracting p from 1.00 and dividing the difference by p. Thus, Θ values consisted of .05, .11, .43, 1.50, 9, and 19. Finally, the options discounting assessment pitted an SR available from two options against an LR from 3, 18, 36, 108, 180, and 360 options. Participants were informed that they could (hypothetically) choose only one reward from these options, but with only 15 s to make the decision. Participants were told the options were subjectively different (i.e., varied in quality) but that they each were worth the given amount (e.g., 2 options worth $500 each or 36 options worth $1000 each). Without such a time limit, it would be unclear whether participants may demonstrate a preference for larger rewards from extensive options simply because they could conceivably take days to evaluate all the options. With no control on deliberation times, any preference for smaller rewards from fewer options could be attributed to a delay discounting effect wherein the deliberation time for the larger array may be so overwhelming (due to the sheer number of items to choose from) that an impulsive choice (the smaller reward from fewer options) is more preferable. In sum, this assessment measured the amount of money participants were willing to forgo in order to choose from a smaller array of options.

Following the instructions, participants completed six practice trials to familiarize themselves with the questions. The sequence of values within each discounting task was randomized accordingly to a computer algorithm. However, the sequence of discounting task presentation was constant for all participants; (a) delay, (b) options, and (c) probability.

2. Results and discussion

The top panel of Fig. 1 depicts subjective value (median score within group) as a function of reward delay, odds against (Θ) reward, or number of extensive choice options. Subjective values followed a decreasing trend for all three discounting dimensions. To better understand the differences in the participants' discounting across modalities (delay, choice, and probability), we employed a quantitative analysis using Green and Myerson's hyperboloid model (2004; see also, Myerson and Green, 1995; McKerchar et al., 2010):

$$V = \frac{A}{(1 + kX)^s} \quad (1)$$

In this hyperboloid model, A represents the amount of the reward, k represents degree/rate of discounting, X represents the values of the independent variable, and s represents participants' individual differences with respect to the nonlinear scaling of amount and the independent variable (IV; e.g., delay, choice options, and odds against reward receipt in probability discounting). Because of differing modalities (and thus, IV scaling), we focused our analysis on the s parameter to evaluate potential differences across modalities. We first established the contribution of the s parameter to an understanding of participants' discounting by evaluating whether s significantly differed than 1.0 (thus, the parameter adds potential information beyond that obtained using a simplified hyperbolic model; e.g., Mazur, 1987) using the Wilcoxon Signed Rank test. For delay, choice, and probability, s significantly differed from 1.0 ($W = -1472$ [$p = .0005$], -1405 [$p < .0001$], -904 [$p = .02$], respectively). Using the Kruskal–Wallis test, we found that s varied significantly across modalities ($H[2] = 10.93$, $p = .004$), with Dunn's Multiple Comparison test identifying a