Journal of Research in Personality 43 (2009) 716–719

Contents lists available at ScienceDirect

Journal of Research in Personality

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

Brief Report

What happens during the free-choice period? Evidence of a polarizing effect of extrinsic rewards on intrinsic motivation

Ben M. Wiechman, Suzanne T. Gurland *

Department of Psychology, Middlebury College, Bicentennial Way, Middlebury, VT 05753, United States

ARTICLE INFO

Article history:
Available online 28 March 2009

Keywords:
Undermining effect
Free-choice paradigm
Self-determination theory
Extrinsic rewards
Intrinsic motivation

ABSTRACT

The "undermining effect" [e.g., Deci, E. L., Koestner, R., & Ryan, R. M. (1999) A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation, *Psychological Bulletin, 125*(6) 627–668], whereby extrinsic rewards decrease intrinsic motivation, is typically tested using the free-choice paradigm. The arbitrary length of the free-choice period, however, might obscure the *process* of undermining. We used a foreshortened free-choice period – immediately and after 1 week – to glimpse the process of undermining with 61 college students who engaged in an intrinsically interesting activity under a reward or no-reward condition. Analyses revealed a polarizing effect of extrinsic rewards on intrinsic motivation for the immediate and delayed assessments. We consider this effect in relation to the process of undermining, and suggest a potential personality-based moderator of the effect.

1. Introduction

The "undermining effect" (Deci, 1971; Deci, Koestner, & Ryan, 1999) refers to decreases in intrinsic motivation (IM) for an activity after the activity is temporarily paired with a social control, such as an extrinsic reward. It has found support across dozens of studies in multiple meta-analyses (e.g., Deci et al., 1999; Tang & Hall, 1995; Wiersma, 1992; though for an opposing view, see Eisenberger & Cameron, 1996), and is thought to occur because rewards pressure people to engage in an activity for the sake of the reward rather than for the inherent enjoyment of the activity itself (e.g., Deci & Ryan, 1987). Abundant empirical support clearly documents the *existence* of the undermining effect, but little attention has been paid to the *process* of undermining. What is happening to IM prior to the emergence of the undermining effect?

A standard measure of IM is the free-choice paradigm, in which participants are left to engage in any of several interesting tasks, including more of the target task, for a brief period when they believe they are no longer being observed (Deci & Ryan, 1985a). A rewarded experimental group is compared to a no-reward control group, and undermining is in evidence if, on average, the rewarded group spends significantly less time than the control group engaging in the target activity during the free-choice period.

The free-choice paradigm leaves two key process-oriented issues under-explored. The first concerns the duration of the free-choice period. How long is long enough – or too long – for undermining to be evident? Does the chosen duration constrain our view of the *process* of undermining? In Deci's (1971) original study, the free-choice period lasted 8 min. Many subsequent studies followed suit, but in others, researchers used 5 min (e.g., Pallak, Costomiris, Sroka, & Pittman, 1982), 6 min (e.g., Ryan, 1982), 10 min (e.g., Morgan, 1981), 15 min (e.g., Perry, Bussey, & Redman, 1977), 20 min (e.g., Morgan, 1983), or even several hours spread out over a number of days (e.g., Greene & Lepper, 1974). The duration of the free-choice period thus seems quite arbitrary.

Intentionally shortening the duration, however, might yield important insights into the process of undermining. In several studies using 6 min or fewer of free-choice time, researchers reported using log, natural log, square root, or arcsine[1] data transformations on their free-choice measure of IM to correct for non-normal distributions or heterogeneity of variances (e.g., Boggiano & Ruble, 1979; Pallak et al., 1982; Plant & Ryan, 1985). Similarly, several studies using 3 h or more reported a log transformation (e.g., Greene & Lepper, 1974; Loveland & Olley, 1979). This pattern of non-normality suggests a distribution that changes over time as the process of undermining unfolds. A "snapshot" of IM scores after 3 min might look quite different from a "snapshot" after 15 min. We might miss this, however, if we force IM data into normal distributions and focus only on measures of central tendency, rather than using nonparametric techniques to examine the tails of the distribution early in the process of undermining. In the current study, we therefore use a foreshortened free-choice period of only

* Corresponding author. Fax: +1 802 443 2072.
E-mail address: sgurland@middlebury.edu (S.T. Gurland).

[1] The arcsine transformation is commonly used when intrinsic motivation times are converted to proportions, since proportions are otherwise binomially distributed (Winer, 1971). In the cases cited here, however, intrinsic motivation was measured as time spent on the target activity, not as a proportion of total time spent.

0092-6566/$ - see front matter © 2009 Elsevier Inc. All rights reserved.
doi:10.1016/j.jrp.2009.03.008

3 min – shorter than any we found elsewhere in the literature – and view any non-normality in the distribution not as a problem to be corrected, but as a window into IM "on the way" to being undermined.

A second under-examined issue with the free-choice paradigm concerns the durability of the undermining effect. Researchers typically test for durability as a between-groups mean difference in IM well after the cessation of the reward. For example, Greene and Lepper (1974) randomly assigned children to draw pictures under a reward, no-reward, or unexpected reward condition in the initial session, without testing free-choice behavior immediately after. One to two weeks later, they conducted a free-choice assessment of IM. This design leaves open the question of whether the same children who evidenced undermining at follow-up would have also evidenced it immediately after cessation of the reward. Occasionally, IM is assessed immediately after reward cessation, and again a week later, but even in these cases, researchers typically test for a mean difference at each time point. Taking a more process-oriented view, we might wish to know the source of the mean differences at each time point. Are nearly all rewarded participants showing a decrease in IM both immediately and upon follow-up? Or are a few influential participants with extreme scores – as are commonly found in non-normal distributions – pulling the mean down? Are the same participants showing the decrease at both time points?

The current study takes a first step in the direction of addressing these under-examined issues. We examine the effect of extrinsic rewards on IM, both immediately after removal of an engagement-contingent reward (Deci et al., 1999) and again one week later. However, we take our "snapshot" of free-choice behavior after 3 min, thereby sampling behavior well prior to the 8-min mark when the undermining effect has typically been documented to have emerged. Further, we take an analytical approach that focuses on the tails of the distribution, and allows us to examine which participants at each time point are responsible for any effect that emerges.

2. Method

2.1. Participants

Participants were 61 students (23 men and 38 women; *M* age = 19.46 years, *SD* = 1.29) from a predominantly white (73%), private, liberal arts college. They were recruited through psychology courses, although 34.4% had not declared a major, and the remaining 65.6% represented 17 different majors.

2.2. Procedure

Participants were first thanked with either a voucher for a free item at a campus restaurant or nominal course credit. We did this up-front so the thank-you would not contaminate participants' subsequent assignment to the reward or no-reward conditions. To further distinguish the thank-you from the experimental reward, the experimenter verbally specified that it was a thank-you simply for participating.

Participants were assigned to a no-reward control group or an experimental reward group using block randomization to ensure even distribution by sex. All participants individually attended a 30-min session and a 15-min follow-up approximately one week later (*M* = 7.38 days, *SD* = 1.46), with none lost to follow-up. For both sessions, the intrinsically interesting target activity was searching for the "hidden Ninas" in the pen strokes of drawings in which artist Al Hirschfeld had famously embedded his daughter's name. This task has been used in past studies (e.g., Harackiewicz, 1979; Morgan, 1983) and we informally pilot-tested it beforehand with 10 students, who verbally reported it was new to them, interesting, and preferable to other options offered.

During the first session, those in the reward group were told they would "receive $1 towards a gift certificate" for each of the five drawings in which they attempted to find the Ninas, "regardless of how many" Ninas they actually found, whereas those in the control group were asked to engage in the activity but were not offered a reward. All participants attempted all drawings (i.e., visually scanned for at least 15 s). After 2 min to search each drawing, participants were given their reward (if in reward-group), and generally led to believe that the session had ended.

In reality, they were then surreptitiously observed during a free-choice period. Specifically, the researcher gave the cover story that he needed to "check on another [participant]... and grab the [final] questionnaire," told participants they could do "whatever you want" in the interim, and directed their attention to five additional Nina drawings, a current issue of Time magazine, and that day's New York Times newspaper. During the researcher's 3-min absence (beginning approximately 3 s later, when he entered the next room), he observed participants through an unobtrusive two-way mirror and recorded the time spent on the target activity. Participants then completed a questionnaire measure of intrinsic motivation and scheduled their follow-up session.

The follow-up session consisted of another free-choice period, identical to the first, but with a different cover story: this time, the researcher needed to use the restroom. As he left, he told participants they were free to do any of the available activities, which included novel Nina drawings and reading material. For 3 min, the researcher surreptitiously recorded time spent on the target activity, then returned. Participants completed a demographics questionnaire and were debriefed.

2.3. Measures

Intrinsic Motivation Inventory (IMI; e.g., Plant & Ryan, 1985; Ryan, 1982). The interest/enjoyment subscale of the IMI measured participants' IM in the hidden Nina task (e.g., "This activity was fun to do"), along a 7-point Likert scale, with higher scores indicating greater interest/enjoyment. Cronbach's alpha was 0.91 in the present study.

Free-choice behavior. Time spent doing the target activity during the free-choice periods was recorded. This measure has been used in the large majority of studies investigating the undermining effect (e.g., Deci, 1971; Morgan, 1983).

Demographics. Participants reported their age, sex, year in school, and major.

3. Results

3.1. Preliminary analyses

The groups did not differ with respect to age, $t(59) = 1.79$, *ns*, sex, $\chi^2(1) = .03$, *ns*, year in school, $\chi^2(7) = 5.47$, *ns*, or major, $\chi^2(17) = 14.57$, *ns*. Pearson's correlations conducted among the IMI and both free-choice measures (Table 1) all showed significant

Table 1
Correlations for self-report and free-choice measures of intrinsic motivation.

Variables	*M*	*SD*	1	2	3
Free-choice Time 1	91.90	76.19	–		
Free-choice Time 2	30.93	64.80	0.37**	–	
Interest/enjoyment	5.27	1.04	0.38**	0.26*	–

* $p < .05$.
** $p < .01$.

positive associations, indicating that the more interested participants were in the hidden Nina activity, the more time they spent engaged in it at both the Time 1 and Time 2 assessments. This is as expected, given that free-choice behavior and the interest/enjoyment subscale both measure IM. Descriptive statistics (Table 1) indicate that, across groups, average time spent on the activity was considerably less at Time 2 than at Time 1, presumably because some novelty had worn off.

3.2. Tests of primary hypotheses

Contrary to predictions, IMI scores were not higher in the control group, $M = 5.18$, $SD = .97$, as compared to the reward group, $M = 5.37$, $SD = 1.12$, $t(57.19) = -0.73$, *ns*.

With respect to the behavioral free-choice measure, consistent with our process-oriented reasoning, the distributions for both Time 1 and Time 2 were non-normal and U-shaped (Fig. 1). The traditional parametric test for an undermining effect (i.e., a comparison of group means) was therefore inappropriate, and indeed, measures of central tendency would be meaningless in such distributions. Further, the U-shape, specifically, made log (or other) transformations not only inappropriate, but undesirable, as the U-shape suggested that whatever phenomenon we were observing had occurred in the tails of the distributions. We therefore selected the Moses test (Moses, 1952), a non-parametric test that identifies differences in the tails of distributions by rank-ordering all the scores in the sample (regardless of group) and examining how clustered versus dispersed the scores in the control group are, relative to the range of all scores. A compact group of control scores suggests that more of the experimental scores fall at the ends of the distribution (i.e., are polarized into high or low IM scores). Comparing the reward group to the control group in this way yielded a significant result for the first, $s^* = 48$, $p < .001$, as well as the second free-choice period, $s^* = 35$, $p < .001$. Both of these remained unchanged after potentially influential outliers were trimmed, as recommended by Moses (1952). This suggests that non-rewarded participants' scores (i.e., the number of seconds they spent searching for Ninas) clustered toward the middle of the distribution, whereas the rewarded participants' scores appeared toward the low or high extremes of the distribution. Rewarding participants thus had both a short-term and a long-term polarizing effect on free-choice behavior.

To test within-subjects, whether participants remained in the same tail of the distribution across the two time points, scores from the behavioral free-choice measure – for the rewarded group only – were dichotomized into high and low, separately for each time point, based on whether they fell to the left or the right of the "cleared-out gap" created by the polarizing effect. These high and low groupings for Time 1 and Time 2 were analyzed with Fisher's exact test, which showed a significant result, exact $p = .05$. Specifically, 19 rewarded participants remained in the same tail in which they had started (15 low and 4 high). Of the rewarded participants who changed groups from Time 1 to Time 2, all 11 went from the high group to the low group. Thus, most of the participants who initially showed a (counter-hypothetical) enhancement effect might be more properly described as having shown a delayed undermining effect.

4. Discussion

This study examined the undermining effect of extrinsic rewards on intrinsic motivation (IM) using an analytic approach that provides for greater focus on undermining as a process, as opposed to strictly an outcome. Specifically, participants engaged in an interesting hidden-figures activity and were either rewarded for it or not. Their IM for the activity was measured in a shorter-than-usual 3-min free-choice period immediately after and one week later. The non-normal distributions of IM scores yielded by

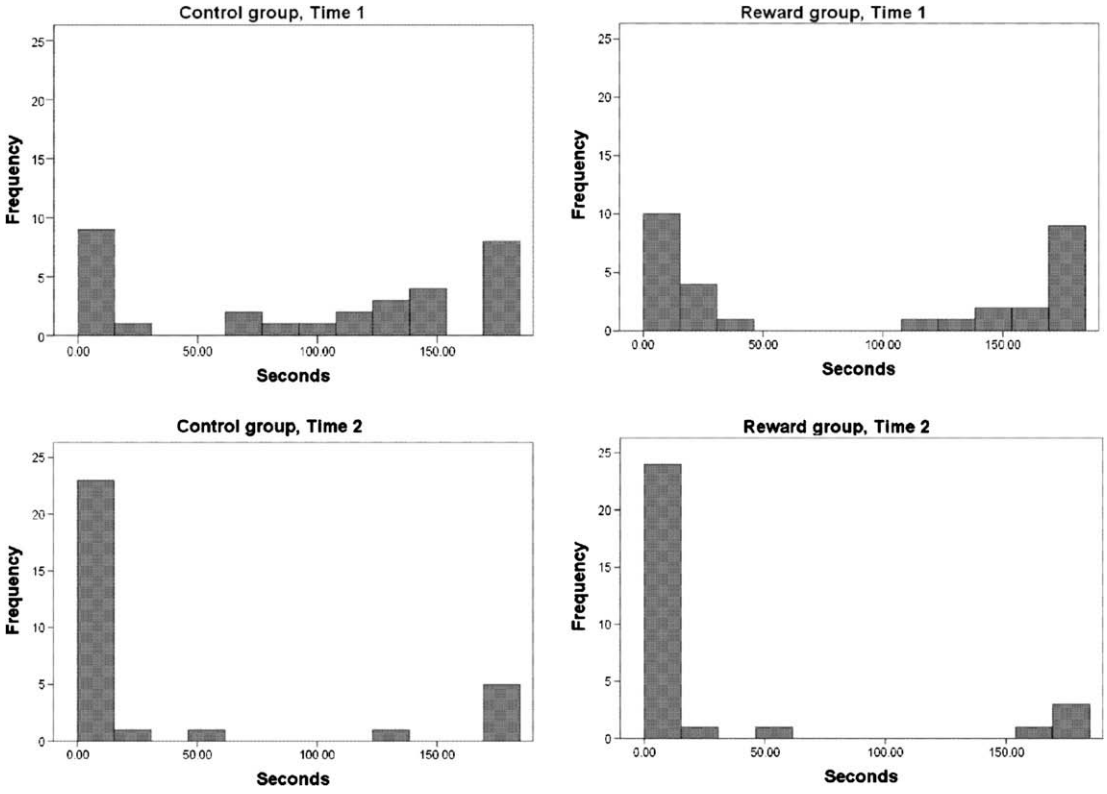

Fig. 1. Frequency distributions for time spent, in seconds, on target activity during first (Time 1) and second (Time 2) free-choice periods, broken out by group.

these foreshortened free-choice periods were viewed as a window into the process of undermining.

The reward and control groups did not differ with respect to self-reported interest/enjoyment in the experimental task. It has been pointed out previously that self-report measures of intrinsic motivation yield smaller effect sizes than the behavioral free-choice measure (Deci et al., 1999). One possible explanation is that rewarded participants might confuse interest in the activity with their enjoyment of the reward (Deci et al., 1999). In other words, although rewarded participants may have no longer been interested in looking for hidden Ninas in Hirschfeld's drawings once the reward was removed, they might have reported high levels of interest simply because they were satisfied with the gift certificates they received. Of further interest, the self-report measure seems to yield a normal distribution consistently across studies. Thus, while it is a less sensitive index of intrinsic motivation (Deci et al., 1999), it may also be less likely to fluctuate with the amount of time elapsed since performing the activity.

Rewards did affect IM, however, as measured by the free-choice paradigm, and this effect persisted over time. Interestingly, the effect was not a classic undermining one, but rather a polarizing effect. We fully expect, on the strength of the existing literature, that if we had continued to observe for several more minutes, we would indeed have seen classic undermining. Thus, it appears that free-choice behavior may briefly polarize prior to settling into the classic undermining pattern. Specifically, the 3-min window gives the appearance that some participants' IM was temporarily enhanced by rewards, while others' was undermined, relative to the control group, both immediately after the reward period and one week later. In Moses' (1952) words, participants have "extreme reactions" to being rewarded, spending nearly all or nearly none of the time engaged in the target activity, while non-rewarded control participants occupy the center of the distribution with moderate amounts of time spent on the target activity. Looking at individual participants' movement within the distribution over time, however, suggests that most of those whose IM had appeared enhanced at Time 1 had moved into the lower tail of the distribution by Time 2. That is, a subset of participants showed what we might call delayed undermining. We suggest the possibility that some individuals initially respond to a controlling reward with "pressured persistence" (Ryan, Koestner, & Deci, 1991), then subsequently succumb to the effect of the reward. In this sense, their behavior during that period does not represent true IM.

Interestingly, this reasoning may apply both within and across free-choice testing sessions. Specifically, it is plausible that single-session studies using longer (e.g., 8-min) free-choice periods find an undermining, but not a polarizing, effect because they measure IM after the "pressured persisters" desist and the distribution has smoothed out. Similarly, the within-subjects analysis in the present study suggests that some participants showed pressured persistence immediately, but not at follow-up. The reappearance of the U-shaped distribution of IM scores at follow-up might suggest that the "extreme reactions" are re-invoked when the activity is reintroduced, but with fewer rewarded participants now exhibiting pressured persistence.

How to predict which participants will react extremely in which direction remains an open question. We tentatively suggest that individual differences in general causality orientation (Deci & Ryan, 1985b) might be a fruitful avenue of exploration. Measures that distinguish pressured persistence from genuine IM would also be helpful in this regard, and their absence is one limitation of the present study. A further limitation is that we shortened, but did not manipulate or repeatedly sample during, the free-choice period. This would have allowed a direct test of whether the distribution of IM scores is smoothing over time – an idea for which the present study provides only indirect support. A final limitation is the possibility of bias, since the experimenter was not blind to condition.

Despite these limitations, the study takes an initial step toward a process view of undermining. It invites future investigation of individual differences as moderating the functional significance (Deci & Ryan, 1987) of rewards and people's responses to them, as well as future designs that manipulate the length of the free-choice period.

References

Boggiano, A. K., & Ruble, D. N. (1979). Competence and the overjustification effect. *Journal of Personality and Social Psychology, 37*, 1462–1468.

Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology, 18*(1), 105–115.

Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin, 125*(6), 627–668.

Deci, E. L., & Ryan, R. M. (1985a). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Deci, E. L., & Ryan, R. M. (1985b). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality, 19*(2), 109–134.

Deci, E. L., & Ryan, R. M. (1987). The support of autonomy and the control of behavior. *Journal of Personality and Social Psychology, 53*, 1024–1037.

Eisenberger, R., & Cameron, J. (1996). Detrimental effects of reward: Reality or myth? *American Psychologist, 51*, 1153–1166.

Greene, D., & Lepper, M. R. (1974). Effects of extrinsic rewards on children's subsequent intrinsic interest. *Child Development, 45*, 1141–1145.

Harackiewicz, J. M. (1979). The effects of reward contingency and performance feedback on intrinsic motivation. *Journal of Personality and Social Psychology, 37*(8), 1352–1363.

Loveland, K. K., & Olley, J. G. (1979). The effect of external reward on interest and quality of task performance in children of high and low intrinsic motivation. *Child Development, 50*, 1207–1210.

Morgan, M. (1981). The overjustification effect: A developmental test of self-perception interpretations. *Journal of Personality and Social Psychology, 40*, 809–821.

Morgan, M. (1983). Decrements in intrinsic motivation among rewarded and observer subjects. *Child Development, 54*(3), 636–644.

Moses, L. E. (1952). A two-sample test. *Psychometrika, 17*, 239–247.

Pallak, S. R., Costomiris, S., Sroka, S., & Pittman, T. S. (1982). School experience, reward characteristics, and intrinsic motivation. *Child Development, 53*, 1382–1391.

Perry, D. G., Bussey, K., & Redman, J. (1977). Reward-induced decreased play effects: Reattribution of motivation, competing responses, or avoid frustration? *Child Development, 48*, 1369–1374.

Plant, R. W., & Ryan, R. M. (1985). Intrinsic motivation and the effects of self-consciousness, self-awareness, and ego-involvement: An investigation of internally-controlling styles. *Journal of Personality, 53*, 435–449.

Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology, 43*, 450–461.

Ryan, R. M., Koestner, R., & Deci, E. L. (1991). Ego-involved persistence: When free-choice behavior is not intrinsically motivated. *Motivation and Emotion, 15*, 185–205.

Tang, S., & Hall, V. C. (1995). The overjustification effect: A meta-analysis. *Applied Cognitive Psychology, 9*(5), 365–404.

Wiersma, U. J. (1992). The effects of extrinsic rewards on intrinsic motivation: A meta-analysis. *Journal of Occupational and Organizational Psychology, 65*, 101–114.

Winer, B. J. (1971). *Statistical principles in experimental design*. New York: McGraw-Hill.