

End Effect Under Negative Expectation: Emotional Motivation Induces Risk Seeking

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Abstract

In risk decision-making, the end effect refers to the phenomenon where individuals' propensity for risk-taking increases at the end of repeated multi-round decision tasks, but its underlying mechanism remains unclear. Results from three experiments found that in both laboratory and natural environments, participants' investments in the final round significantly increased under different expectation conditions (negative expected value and equal expected value), the end effect appeared consistently, and was not influenced by the number of tokens participants possessed before the final round decision. That is, even when the risky option yielded smaller returns, participants still tended to choose the high-risk option in the final round, and this effect was reference-point independent, which suggests that the emergence of the end effect stems from the pursuit of emotional satisfaction. Future research could start from this point to further investigate the mechanisms through which emotions influence the risk decision-making process.

Full Text

The Ending Effect Under Negative Expected Value Conditions: Emotional Motivation Induces Risk-Seeking

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Abstract

The ending effect in risky decision-making refers to the phenomenon where individuals exhibit increased risk-taking tendencies as a repeated multi-round decision task approaches its conclusion. Three experiments examined this effect across different expected value conditions (negative and equal expected values) in both laboratory and natural environments. The results demonstrated that

participants significantly increased their investments in the final round across all conditions, with the ending effect emerging reliably regardless of whether the expected value was negative or equal. Crucially, this effect was not moderated by the number of tokens participants possessed before the final round. These findings indicate that even when risky options yield smaller expected payoffs, individuals still prefer them in the final round, suggesting that the ending effect is reference-independent and driven by the pursuit of emotional satisfaction. Future research should further investigate the mechanisms through which emotion influences risk decision-making processes.

Keywords: ending effect; risky decision-making; reference-independent; socioemotional selectivity theory; emotional motivation

Classification Code: B849

1 Introduction

Decision-making is a cognitive process of selecting among multiple possible beliefs or behaviors (Hogarth & Reder, 1986). In recent years, the “ending effect” in decision-making has garnered increasing attention. Also known as the “last race effect,” this phenomenon describes how individuals’ behavioral patterns shift at the conclusion of repeated multi-round decision tasks, manifesting in the domain of risky decision-making as an elevated tendency toward risk-taking (e.g., McKenzie et al., 2016; Xing, Meng, Isaacowitz, Wen, & Line, 2018). Previous research has documented the existence of the ending effect through multiple methods and contexts, including horse race betting (e.g., Asch, Malkiel, & Quandt, 1982; Ali, 1977; Kopelman & Minkin, 1991; Metzger, 1985; McGlothlin, 1956), laboratory-simulated gambling (e.g., McKenzie et al., 2016), and laboratory risk decision tasks (Xing et al., 2018). However, the underlying mechanism remains unresolved.

Early research speculated that the ending effect was a “reference-dependent” behavior, where individuals’ decisions to increase risk-taking in the final round depended on their position relative to a reference point—specifically, the relationship between their token holdings before the final round and their initial amount (Thaler & Johnson, 1990; Thaler & Ziemba, 1988). Recent empirical work has challenged this hypothesis. McKenzie and colleagues (2016) had participants complete repeated multi-round risk decision tasks (Experiments 1 and 2) and a simulated horse race task (Experiment 3), choosing between risky and safe options. Their results showed that regardless of whether participants had won or lost money before the final round, they exhibited clear risk preferences upon realizing it was the final task, suggesting the ending effect may be a reference-independent process. According to socioemotional selectivity theory (SST; Carstensen, 2006; Carstensen, Isaacowitz, & Charles, 1999), shifts in time perception lead to motivational changes. When facing endings, people prioritize achieving emotional satisfaction; conversely, when time is perceived as unlimited, they focus more on long-term goals such as knowledge acquisition (Carstensen et al., 1999; Carstensen, 2006). Building on SST, Xing et al. (2018)

investigated the relationship between motivational shifts and the ending effect. In their experiments, participants completed a series of risky investment tasks, revealing that individuals at task conclusion were more likely to satisfy their emotional needs (Experiment 3), and this motivational state change could partially explain the ending effect (Experiment 4). Thus, current research proposes that the ending effect stems from the pursuit of emotional satisfaction rather than higher monetary gains (Xing et al., 2018).

Based on previous research, we hypothesized that the ending effect is not influenced by the mathematical expected value of risky options in decision tasks. As long as risky options can satisfy individuals' goals of pursuing emotional satisfaction, the ending effect should emerge even when the expected value is negative. However, existing research on the ending effect has employed only equal-expected-value gambles and positive-expected-value gambles, where the expected payoff from choosing the risky option equals or exceeds that of the safe option. Consequently, the preference for risky options in the final round could also be interpreted as a choice to pursue higher monetary gains, making it impossible to disentangle the two motivations. The present study incorporates loss-expected-value gambles, where the expected payoff of risky options is lower than that of safe options. If participants' motivation at task conclusion is to obtain emotional satisfaction, they should choose risky options and exhibit the ending effect, as these options might yield high payoffs that satisfy emotional needs at the ending. If their motivation is to pursue higher monetary gains, they should choose safe options and the ending effect should not occur, since risky options have lower expected values. Thus, using negative-expected-value decision tasks helps separate these two motivations. If the ending effect still emerges under negative-expected-value conditions, it would provide further support for the view that the ending effect is caused by the pursuit of emotional satisfaction (McKenzie et al., 2016; Xing et al., 2018).

This research comprises three experiments. Experiment 1 employs a classic repeated decision-making paradigm—simpler and clearer than horse race betting tasks—to replicate recent findings, testing whether the ending effect reliably exists and verifying the reference-independence assumption. Experiment 2 investigates whether the ending effect persists when risky options are non-optimal (negative expected value). Previous research provides preliminary evidence that the ending effect may be driven by non-rational factors, and we anticipate that our findings will further support this: the ending effect should emerge in both equal-expected-value (Experiment 1) and negative-expected-value (Experiment 2) tasks, with significantly higher investments in the final round compared to previous rounds (Hypothesis 1). Additionally, we expect to replicate McKenzie et al.'s (2016) finding that the ending effect is not moderated by the amount of tokens held before the final decision round (Hypothesis 2). Experiment 3 extends these findings through a field study.

Experiment 1

2.1.1 Participants

To determine the sample size for Experiment 1, we conducted a power analysis using *GPower software* (Faul, Erdfelder, Lang, & Buchner, 2007; Faul, Erdfelder, Buchner, & Lang, 2009; Kelley, Eastwick, Harmon-Jones, & Schmeichel, 2015). The effect size was drawn from previous research ($p^2 = 0.069$; see Xing et al., 2018). Since the ending effect would produce unequal differences across rounds, violating the sphericity assumption, the nonsphericity correction parameter in *GPower* should be at least 0.75; we therefore set this parameter to 0.75. The analysis indicated that at least 14 participants were needed to achieve adequate statistical power ($\beta = 0.95$, the *G*Power* default). Experiment 1 recruited 22 university students (4 male, 18 female), consistent with sample sizes used in previous research (Xing et al., 2018, Experiment 1).

2.1.2 Procedure

The experimental paradigm was adapted from Shiv, Loewenstein, Bechara, Damasio, & Damasio (2005). Participants began with 10 tokens and were informed that: (1) their final compensation would equal the number of tokens remaining at experiment's end; (2) if the final token count was negative, they would need to either perform labor (translating English articles) or pay the experimenter an amount equivalent to the token deficit (to ensure participants believed they could actually lose money, following Scholer, Zou, Fujita, Stroessner, & Higgins, 2010). In practice, participants who finished with fewer than 5 tokens still received 5 yuan compensation.

Participants then completed a 20-round decision task. In each round, they first decided whether to invest. If they chose to invest (the risky option), they gave the experimenter 1 to 5 tokens. The experimenter then rolled a die; if the result was "1" (probability = 1/6), the investment succeeded and the experimenter returned six times the invested amount. If the result was not "1" (probability = 5/6), the investment failed and the invested tokens were forfeited. If participants decided not to invest (the safe option), the experimenter still rolled the die, but after participants learned the result, they proceeded directly to the next round with no change to their token holdings.

Finally, participants completed a demographic information form (including age, gender, etc.), and the experimenter paid them according to their task performance.

2.2 Results

2.2.1 The Effect of Ending on Risk-Taking Tendency A repeated measures ANOVA on investment amounts across rounds revealed that the final round ($M = 1.18 \pm 1.01$) showed significantly higher investment than the previous round (Round 19: $M = 0.64 \pm 0.73$, $F(1, 21) = 5.86$, $p = 0.025$, $p^2 =$

0.218). Compared to all other rounds, the final round' s investment amount was significantly greater ($F(1, 21) > 3.04$, $p_s < 0.10$, $p^2_s > 0.127$), except for Round 6 ($M = 0.82 \pm 1.01$, $F(1, 21) = 1.846$, n.s.). When comparing each round to the overall mean investment ($M = 0.64 \pm 0.31$), only the final round differed significantly ($F(1, 21) = 6.80$, $p = 0.016$, $p^2 = 0.245$). These results replicate the ending effect, consistent with Hypothesis 1 and previous research [Figure 1: see original paper].

2.2.2 Moderating Effects of Pre-Final-Round Wins and Token Holdings To test whether the ending effect is reference-independent, we conducted a multiple linear regression analysis with pre-final-round wins and token holdings as independent variables and the difference between final-round investment and mean investment of the first 19 rounds as the dependent variable. Wins were defined as the number of times participants invested and rolled a “1” in the first 19 rounds; token holdings represented the number of tokens participants possessed before the final round (including the initial 10 tokens). As shown in Table 1, neither pre-final-round wins nor token holdings moderated the ending effect, consistent with Hypothesis 2 and demonstrating that the ending effect is indeed reference-independent, as shown in recent research.

Experiment 2

3.1.1 Participants

Twenty-three university students (5 male, 18 female) were recruited.

3.1.2 Procedure

The procedure was identical to Experiment 1, except the risky option had a lower expected value than the safe option: when participants chose to invest and the die showed “1” (probability = 1/6), they received five times their investment (rather than six times). If the result was not “1” (probability = 5/6), the investment failed and tokens were forfeited. If participants chose not to invest (the safe option), the experimenter still rolled the die but their token holdings remained unchanged.

3.2 Results

3.2.1 The Effect of Ending on Risk-Taking Tendency A repeated measures ANOVA revealed that the final round' s average investment ($M = 1.57 \pm 1.62$) was significantly higher than the previous round (Round 19: $M = 1.09 \pm 1.20$, $F(1, 22) = 4.88$, $p = 0.038$, $p^2 = 0.182$) and all other rounds ($F(1, 22) > 3.52$, $p_s < 0.08$, $p^2 > 0.138$), except Round 4 ($M = 0.96 \pm 0.88$, $F(1, 22) = 2.55$, n.s.). Final-round investment was also significantly higher than the overall mean investment ($M = 0.81 \pm 0.60$), $F(1, 22) = 9.14$, $p = 0.006$, $p^2 = 0.294$. Despite the risky option having lower expected value, participants still showed

significantly increased risk-taking in the final round, consistent with Hypothesis 1 [Figure 1: see original paper].

3.2.2 Moderating Effects of Pre-Final-Round Wins and Token Holdings Following Experiment 1, we tested the moderating effects of pre-final-round wins and token holdings through multiple linear regression. As shown in Table 1 and consistent with Hypothesis 2, neither variable moderated the ending effect, demonstrating that the ending effect remains reference-independent even in negative-expected-value tasks.

Experiment 3

4.1 Method

Given that the first two studies were laboratory experiments with limited ecological validity, Experiment 3 conducted a field study on betting behavior during the 2018 FIFA World Cup. Data were obtained from 500 Lottery Net (<http://www.500.com/>), using transaction share and transaction amount variables. All 64 World Cup matches were labeled sequentially from Match 1 to Match 64 according to their chronological order.

4.2 Results and Discussion

To test for the ending effect, we aggregated transaction amounts and shares across all 64 matches. Since the website provided aggregate data for all bettors rather than individual participant data, statistical testing was not possible. Nevertheless, as shown in Figure 2 [Figure 2: see original paper], bettors' risk-taking behavior (betting participation) displayed a clear ending effect, consistent with the laboratory studies and previous research.

Based on the bookmaker profit/loss data provided for each match (where positive values indicate bookmaker profit and bettor losses, and negative values indicate bookmaker loss and bettor profit), we calculated a bookmaker profit index using the formula:

$$\text{Bookmaker Profit Index} = \text{Bookmaker Profit/Loss} \div \text{Transaction Amount}$$

Positive index values indicate bookmaker profit and overall bettor losses; negative values indicate bookmaker loss and overall bettor profit. Higher values represent greater per-unit betting losses for participants.

As shown in Figure 2 [Figure 2: see original paper], bettors experienced overall losses in all matches except Match 5 (bookmaker profit index = -0.576; $M = 0.175$, $SD = 0.171$). Thus, the ending effect persisted even when betting was unprofitable for participants, consistent with Experiment 2' s findings.

5 General Discussion

The present research demonstrates that the ending effect emerges in both laboratory and natural environments, under both equal-expected-value and negative-expected-value conditions: participants' risk-taking (investment amounts) increased significantly in the final decision round. Individuals exhibited elevated risk-taking in the final round even when knowingly facing risky options with lower expected payoffs than safe options, supporting our hypothesis that the ending effect is unaffected by the mathematical expected value of risky options. As long as risky options can satisfy individuals' goals of pursuing emotional satisfaction, the ending effect emerges even when expected values are negative. Moreover, the analysis of World Cup betting data in Experiment 3 supports this hypothesis. Although this field study has limitations—such as being based on aggregate rather than individual data, preventing statistical verification—the clear ending effect visible in Figure 2 provides strong ecological validity. Another limitation is that the final match was the championship final; while the importance of preceding matches also increased, no corresponding betting increase occurred, suggesting the effect is not merely due to match significance. As a field study with high ecological validity, Experiment 3 provides robust support for the ending effect.

This research is grounded in the assumption that the ending effect reflects an intrinsic, universal cognitive processing characteristic that is reference-independent. Our tests of the moderating effects of pre-final-round wins and token holdings revealed no influence of these variables on the ending effect, consistent with McKenzie et al. (2016) and confirming that the ending effect is indeed reference-independent.

Although the ending effect was identified decades ago (Asch et al., 1982; Ali, 1977; McGlothlin, 1956) and early theoretical discussions existed (Thaler & Johnson, 1990; Thaler & Ziemba, 1988), empirical investigation only began recently (McKenzie et al., 2016; Xing et al., 2018). Previous research indicated the ending effect is reference-independent (McKenzie et al., 2016) and that increased motivation for emotional satisfaction when facing endings may be the underlying mechanism (Xing et al., 2018). However, a limitation of prior studies was their exclusive use of equal-expected-value and positive-expected-value tasks, where risky options could serve both emotional satisfaction and higher economic gain goals. Thus, the possibility that the ending effect was driven by pursuit of higher monetary rewards could not be ruled out. The present study found the ending effect in negative-expected-value tasks and in real-world negative-expected-value risk-taking (World Cup betting), providing further evidence for the motivational explanation of the ending effect.

The revealed mechanisms have substantial practical implications. Understanding the ending effect can help decision-makers optimize their processes and avoid high-risk decisions when perceiving remaining time shift from unlimited to limited. For instance, the “59-year-old phenomenon” refers to corruption among

officials approaching retirement, including previously honest officials who take corrupt risks to “make a big score” before leaving office (Zheng, 2000; Ren, 2000). Previous reflections on this issue have primarily adopted economic perspectives, but our findings suggest that motivational shifts and increased emotional needs when facing career endings likely play a role. Following this logic, providing high-level affirmation of officials’ careers, granting substantial honors, or otherwise satisfying their pursuit of an emotionally rewarding career conclusion before retirement could effectively prevent the “59-year-old phenomenon” at minimal economic cost. Building on this research to develop nudge interventions for the “59-year-old phenomenon” could not only save substantial national resources but also help officials avoid this trap and exit their lifelong careers with dignity.

This research has several limitations and directions for future investigation. First, we only examined the mechanism from a behavioral experimental perspective; future research should explore the neural mechanisms. However, since the ending effect focuses on risk-taking changes in a single final round, neuroimaging techniques like ERP that require signal averaging across trials face technical challenges. Future studies should explore alternative methods to address this issue. Second, our paradigms were description-based decision tasks. According to Knight (1921), decisions under uncertainty can be divided into two types: decisions from description (DFD), where possible outcomes and probabilities are known, and decisions from experience (DFE), where outcomes and probabilities must be learned through experience (Hertwig, Barron, Weber & Erev, 2004). Research suggests these decision types involve different neural pathways; for example, in DFE paradigms, the heuristic system is more active early on, while the analytic system becomes dominant in later trials (Brand, Labudda, & Markowitsch, 2006; Wood & Bechara, 2014)—the opposite pattern of description-based decision processing. This provides a new direction for future research to examine potential differences in the ending effect between these two decision types. Finally, although Experiment 3 provided field evidence, its aggregate-level data prevented statistical hypothesis testing, limiting its persuasiveness. Additionally, since the final match was the championship final, increased betting amounts and participation might have been influenced by match type and intensity rather than solely the ending effect.

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