thappad se darr nahi lagta sahab, Framing Effect se lagta hai

Pranjal Thapliyal[1,*], **Priyanshul Govil**[1,*]

[1] International Institute of Information Technology, Hyderabad

November 27, 2022

Abstract

The framing effect, identified by Tversky and Kahneman, is one of the most striking cognitive biases, in which people react differently to a particular choice depending on whether it is presented as a loss or as a gain. Martino et al. 2006 verifies the framing effect in a university-setting. After incorporating some design changes to the aforementioned, we corroborate most of the results, while disagreeing with some of them. We look at other factors that might influence framing effect, and conclude that the initial monetary amounts and gender of the participant play a significant role in deciding the intensity of the framing effect. Our contributions open up scope for further exploratory research; we formulate a hypothesis and call upon readers to corroborate the claim.

GitHub repository: EagleEyeFalconArrow/FramingEffect

Keywords: *framing effect; decision making*

1. Introduction

The way choices are presented to humans significantly affects how those choices are perceived, and the final decision taken. This observation has popularly been termed as the "Framing Effect". It shatters the idea of rationality and invariance; that there is logical consistency across individuals' decisions, regardless of the way in which choices are presented.

Standard theories that worked on decision making emphasized on the role of *analytical* thinking. Framing effect looks at how emotions affect our decisions. The reference paper [1] tries to look at the neuro-biological aspect of the framing effect. We try to replicate this paper without the neuro-biological aspect, and try to verify if their observed results hold in our setting.

2. Related Work

[2] shows that multiple different theories have been formulated to explain the framing effect, and they are divided into formal, cognitive, and motivational theories.

Prospect Theory (formal) tries to explain the framing effect in terms of the value of goods perceived from a reference point [3], [4]. How an individual perceives an outcome as a gain or a loss is dependent on their reference point, which is generally their asset level. Decision makers are more sensitive to losses than to gains and exhibit diminishing marginal sensitivity to both.

* denotes co-first authorship

Cognitive theories exist which aim at determining the cognitive processing that is involved in weighting outcomes. The fuzzy-trace theory suggests that participants tend to follow a path of greatest simplicity by using simplification mechanisms to reduce cognitive demands [5].

Choice is defined as a result of a compromise between the desire to make a correct decision and the desire to minimize the effort by the cognitive cost-benefit theory [6].

Motivational theory models state that decision makers assign stronger value to displeasure-feelings than to pleasure-feelings, and that this disparity proportionately increases with the amount of risk involved in a decision [7].

3. Methods

We try to replicate the study conducted in 2006 by Martino et al. [1] to see if the results are valid nearly two decades later. With a few changes, we try to keep the rest of the experimental design original to the reference paper.

3.1. Variations from Reference Paper

- We switch to a between-subjects design to account for the Hawthorne effect when presenting subjects with both types of framing.
- We vary the initial monetary amount I to study its correlation with the behavioral tendency to gamble. This is done in 4 discrete values - **100**, **500**, **1000**, **2000 INR**.
- We vary the retained amount as a percentage of the initial momentary amount in the *sure* choices to observe the presence (if any) of correlation of the sure choices' expected utilities and framing effect. This is done in 4 discrete values - **20%**, **40%**, **60%**, and **80%**.

3.2. Sampling

40 participants were sampled using convenience sampling within IIIT, Hyderabad campus belonging to the 18-20 age group with income <10k per month. They were randomly split into two groups - gain and loss. Both groups had an equal ratio-split of 50% male candidates and 50% female candidates. We did not get participation from other genders.

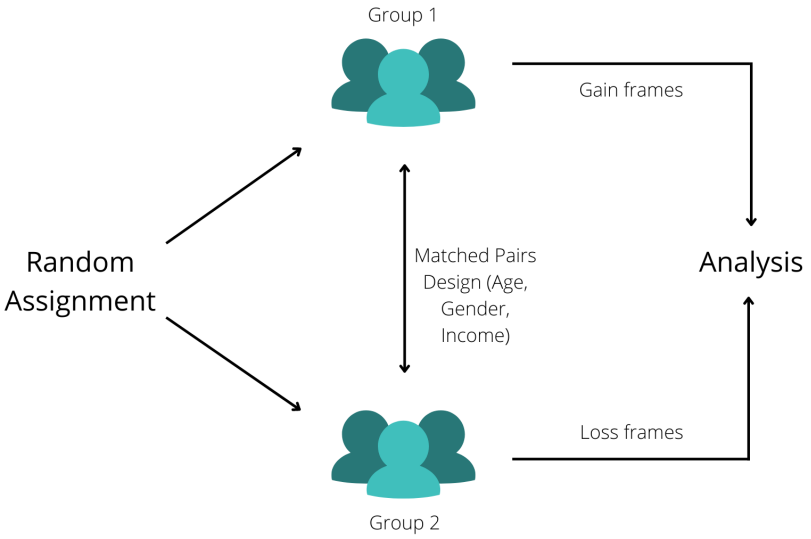

Figure 1. Visualization of the ED process

3.3. Experimental Process

3.4. Task

A *task* is defined as a question with two choices - sure or gamble. An experiment consists of 16 tasks. Through an initial message, subjects were intimated about an initial monetary amount I that they receive for the task. Then, they were required to choose between the *sure* option and the *gamble* option.

The sure option is presented in two frames - *gain* and *loss*. The gain frame is defined as keeping an amount X while the loss frame is defined as losing an amount $I - X$. As this is a between-subjects design, one group receives the loss frame, whereas, the other group receives the gain frame. The gamble option is presented in a consistent way regardless of the type of frame; subjects will be able to gamble their initial monetary amount to **(1) keep it all**, or **(2) lose it all**.

Figure 2. Example of corresponding gain-loss frames

3.5. Experimental Design

Because the experiment follows a between-subjects design, each participant receives tasks either from the gain frames, or the loss frames. These participants are matched by their age, gender, and income levels. Due to non-availability of a randomly sampled population, we restricted participation to participants earning less than 10k INR in a month. Due to sampling being amongst freshmen and sophomores, the participants belonged to the 18-20 age group, and thus had similar cognitive capabilities.

Each participant was approached individually and was asked to participate online in the experiment. The experiment lasted for around 2 minutes; participants were initially explained the tasks and were monitored to avoid noise in the data due to distractions.

4. Results and Discussion

The results obtained post-analysis are documented below. We observed similar effects to the reference paper, and some effects that open up potential areas of study.

It can be seen from Figure 3 that loss frames tend to have more people choosing the gamble option than gain frames ($54.38\% > 45.94\%$). However, the effect of framing is significantly lower than the reference paper ($61.6\% > 42.9\%$). In further analysis, we try to explore why such is the case.

Figure 4 shows that in general, loss frames had higher number of participants choosing the gamble option than their gain frames' counterparts, by a significant margin.

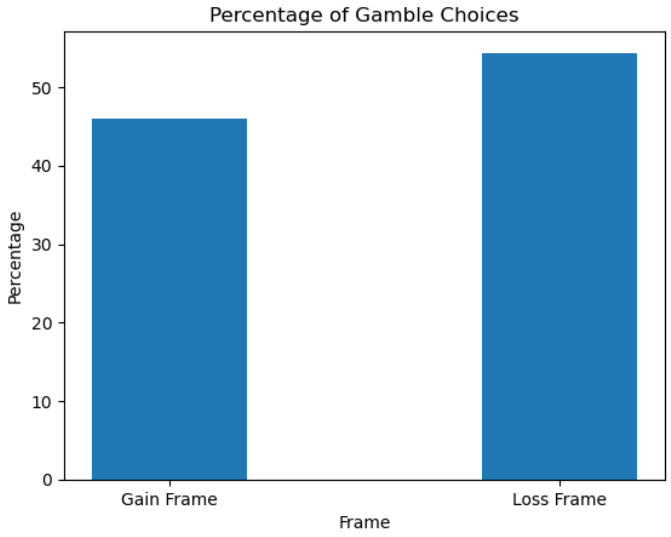

Figure 3. Difference in participants selecting gamble option in different framing

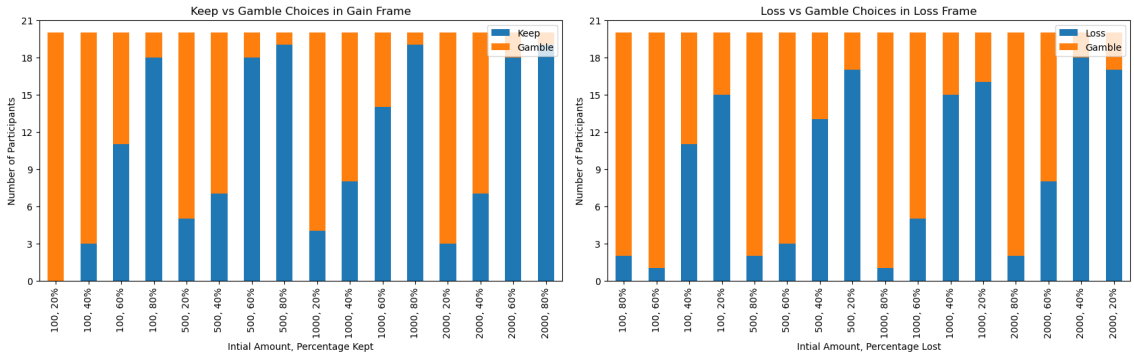

Figure 4. Sure vs Gamble Choices

This can be seen even more clearly by the representation in Figure 5. The difference in the gambling choices is distinctly visible in the middle region of the plot on the horizontal axis: from 100, 80% to 1000, 40%. Thus, it is clear that the initial monetary amounts and the percentages retained of them affect the significance of framing effect.

Figure 6 shows the significance of framing effect due to variance of the initial monetary amounts. We see that for extreme amounts (INR 100, 2000), the number of participants choosing the gamble option in each frame remain almost similar. The tendency to gamble decreases with the increase in the initial monetary amount, with INR 500 being a notable exception. The framing effect is most significant at this value, and we feel that this value is the pivot point in a concave function of intensity of framing effect due to the initial monetary amounts. However, further study is required to corroborate this claim.

Figure 7 shows the intuitively obvious: as a higher percentage of the money is offered in the sure option, the tendency to gamble decreases significantly. The framing effect is observed with the most intensity in the case of maximum percentage retained, which we believe is due to extremely-polar risk profiles of the sampled population.

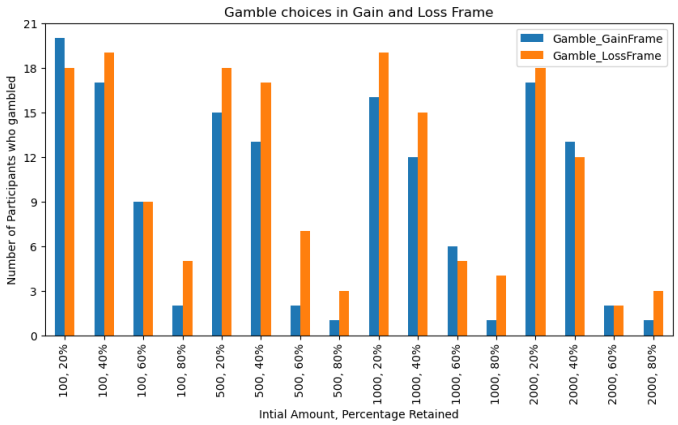

Figure 5. Sure vs Gamble Choices (Aggregate)

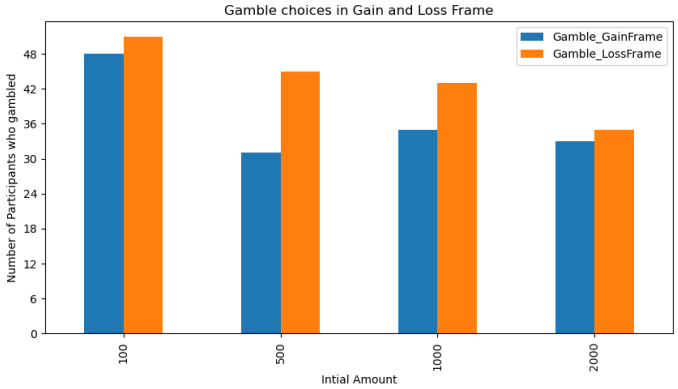

Figure 6. Framing-effect due to Initial Monetary Amount

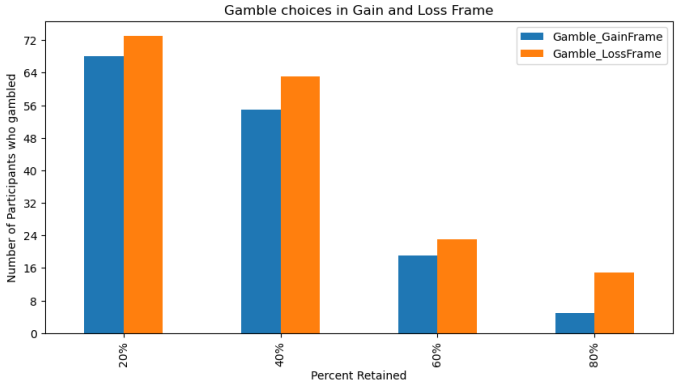

Figure 7. Framing-effect due to Retained Percentages of Amount

Table 1. Response Time Statistics (all values in seconds)

Frame	Mean Response Time	Standard Deviation
Average	6.79	-
Gain	5.71	0.89
Loss	7.81	2.68

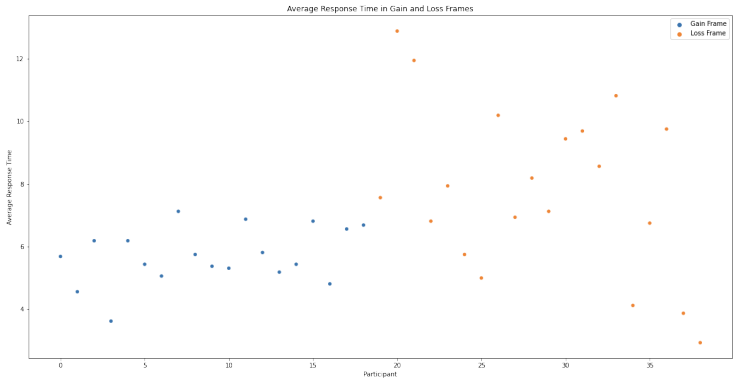

Figure 8. Scatter Plot of Average Response Times

Aggregate response times of participants were collected for all 16 tasks, and were used to calculate the mean response time. Data points lying outside of the interquartile range were treated as outliers, and removed before further analysis.

Data post-cleaning has been documented in Table 1 and Figure 8 depicts a scatter plot to visualize the spread of the data points. We observed reaction times significantly different than the claim made in the reference paper; the average response time was 6.79s (reference paper $\approx$ 1.8s). We observed that the response times in the gain frames were relatively less (M = 5.71s, SD = 0.89s) than the loss frames (M = 7.81s, SD = 2.68s). We observed that the loss frames had a higher mean response time and a wider spread, which indicates that loss frames were cognitively more intensive.

Finally, Figure 9 shows the role of gender in the intensity of framing effect. We observed framing effect to be more in females (10.00% $>$ 6.88%). We also observed that female participants tend to be more risk-averse.

5. Conclusion

We tried to corroborate the results of Martino et al. [1] which was published nearly two decades ago. We incorporated minor design changes to account for potential unintended effects, and a more comprehensive analysis. Albeit on a smaller scale, we observed similar effects. We saw that negative framing results in participants gambling more frequently, which is also directly dependent on the initial monetary amounts and the percentages with which participants can keep the money in the sure frames. We hypothesize that the intensity of framing effect is a concave function of the initial monetary amount, and we call upon readers to corroborate this claim. Our study did not agree with the reference paper on the average response times of the participants, with our results tending to be more than twice of theirs. We conclude that loss frames are more load-intensive cognitively, and that while females are more risk-averse, they tend to display a greater intensity of framing effect over males.

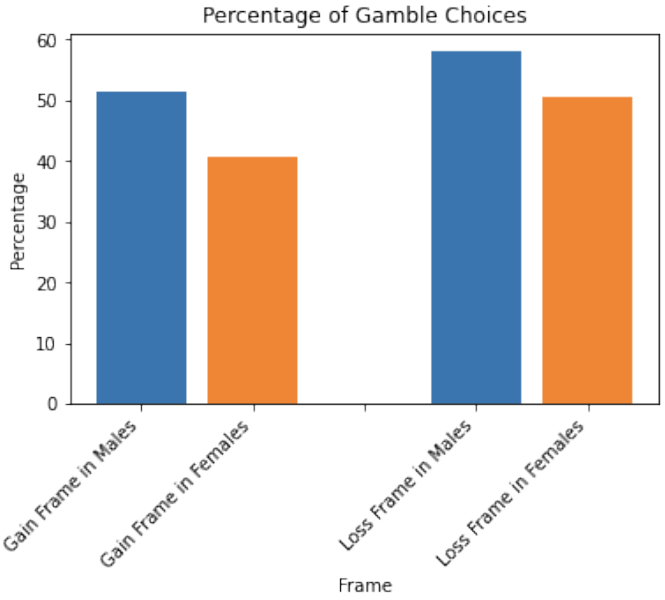

Figure 9. Intensity of framing effect by Gender

References

[1] De Martino, Benedetto, et al. "Frames, biases, and rational decision-making in the human brain." Science 313.5787 (2006): 684-687.

[2] Kühberger, Anton. "The influence of framing on risky decisions: A meta-analysis." Organizational behavior and human decision processes 75.1 (1998): 23-55.

[3] Kahneman, Daniel, and Dale T. Miller. "Norm theory: Comparing reality to its alternatives." Psychological review 93.2 (1986): 136.

[4] Tversky, Amos, and Daniel Kahneman. "Rational choice and the framing of decisions." Multiple criteria decision making and risk analysis using microcomputers. Springer, Berlin, Heidelberg, 1989. 81-126.

[5] Reyna, Valerie F., and Charles J. Brainerd. "Fuzzy-trace theory and framing effects in choice: Gist extraction, truncation, and conversion." Journal of Behavioral Decision Making 4.4 (1991): 249-262.

[6] Payne, John W., et al. The adaptive decision maker. Cambridge university press, 1993.

[7] Mellers, Barbara, Alan Schwartz, and Ilana Ritov. "Emotion-based choice." Journal of Experimental Psychology: General 128.3 (1999): 332.