

Testing Zero's Doppelgangers, A Study on the Framing Effect

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Abstract

This paper takes inspiration from a paper published a year back (Wardley and Alberhasky (2021)), studying the framing effect, specifically the framing of zero in choice problems that are prevalent in the field of behavioural economics. In our study, we aim to push the experiments beyond the examples that have been cited, to try and deduce new results or to prove once again that people conform to theories that have been proposed prior to this. We replicated the experiments conducted in the reference paper and analysed these preliminary results to see if they are as expected from previous evidence. We also took inspiration from the questions designed by the authors, and designed four new questions, that are designed to test specific aspects of decision making towards the framing of gain and loss questions. Collected data was analysed using Chi-square test of independence and ANOVA. The results of part 1 of experiment 1 show that while slight, the effects of framing zero that have been showcased in our reference paper do stand true, as the behaviour of people seems to flip. The results of experiment 2 show the inclination of people to fall for the framing effect when given two choices of equal value. It also proves the proposals put forth by prospect theory.

Need to add details after analysing and results for the last qs.

Keywords: Behavioral Economics, Framing Effect

1. Introduction

The framing effect is an elementary and simple effect in the field of behavioural economics. At its core, it refers to the sway present in our decision making processes that arise due to simple cues that stem from the way a certain choice is presented to us. The consequences of the framing effect however, are very visible and cause people to make irrational decisions even when critically analysing the choices at hand. It is essentially an inherent cognitive bias that can be leveraged for various purposes simply by modifying the presentation of the information in the choice. This effect has been thoroughly analysed by many researchers throughout the years, and it also plays a crucial role in studies regarding behavioural economics and psychology. We attempt to further the studies conducted by analysing a specific

aspect of the decision making process that surfaces due to the framing effect, and to verify that the way a zero is framed in a choice (Wardley and Alberhasky (2021)) does influence people to a certain degree. We attempt to take the essence of the experiments used, namely Kahneman and Tversky (1984), problem 3 and 4, along with Bateman’s (Ian J. Bateman and Starmer (2006), Ian J. Bateman and Starmer (2007)) experiment, and imbue them into the questions we design, to effectively get a better estimate of the behaviour that is showcased.

The flow of the paper is as follows. We first state the experiment design and limitations, along with problems and other logistics we had to handle for conducting the experiment. We then move on to presenting the data collected along with our statistical analysis of the obtained data, after which we give a few concluding remarks regarding the experiment and our findings.

2. Experiment Design

We used Google forms to conduct the experiment. Three forms were created, two of them for Experiment 1 and one for Experiment 2. The demographic for both experiments was the same, which included college undergraduate students from first year students to fourth year students. All participants were volunteers, no one was forced to participate in the study. All currencies have been converted to INR to ensure the same value criterion is being used by all participants.

2.1 Experiment 1

This experiment was a recreation of a few parts of the paper, namely the modified versions of Kahneman and Tversky’s problem 3 and 4, along with Bateman’s experiment with the significant questions. For experiment 1, we made two forms to accommodate for Bateman’s experiment. The first form included the following questions

Which one of the given choice would you prefer? *

☐ A sure gain of 8000 rupees

☐ A 50% chance to gain 16000 rupees and a 50% chance to lose nothing

Figure 1: Question 1, gain frame

The two questions included are the modified versions of Kahneman’s experiment, with the changes being that of the way zero is framed. Gain nothing and lose nothing are the two variations of framing zero.

For question 3 (Bateman’s experiment), we had two variants (Fig 3. and Fig 4. which are shown below.

Question 4 (Fig 5.) was the same for both forms, which was affect heuristic oriented.

Which one of the given choice would you prefer? *

- ☐ A sure loss of 8000 rupees
- ☐ A 50% chance to gain nothing and a 50% chance to lose 16000 rupees

Figure 2: Question 2, loss frame

You are given a gamble where you have a 20% chance to gain 725 rupees and an 80% chance to gain nothing. *

How attractive do you think the bet is (on an 11-point scale, with 10 being very attractive and 0 being not at all attractive, with 5 as indifferent)

	0	1	2	3	4	5	6	7	8	9	10	
Not at all attractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very attractive

Figure 3: Question 3 v1, Bateman cell 1

The first 2 questions of this experiment will be referred to as part 1 of this experiment, while the last 2 will be referred to as part 2 of experiment 1.

Form 1 received 44 responses, while form 2 received 27. So totally questions 1 and 2 (Modified Kahneman) have 71 responses, while Bateman's experiment have a skewed number of responses for the two cells. All responses were used in analysis.

You are given a gamble where you have a 20% chance to gain 725 rupees and an 80% chance ^{*} to lose 5 rupees.

How attractive do you think the bet is (on an 11-point scale, with 10 being very attractive and 0 being not at all attractive, with 5 as indifferent)

	0	1	2	3	4	5	6	7	8	9	10	
Not at all attractive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very attractive

Figure 4: Question 3 v2, Bateman cell 2

How happy do you feel about the above bet? (On a 11-point scale, with 10 as very happy and 0 ^{*} as not at all happy, 5 as indifferent)

	0	1	2	3	4	5	6	7	8	9	10	
Not at all happy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very happy

Figure 5: Question 4, Bateman affect heuristic

2.2 Experiment 2

This experiment was devised entirely by us, and is novel. We designed four questions that were inspired from the experiments conducted in the reference paper. The first two questions added another layer of gambling in the question, giving them one sure option along with another double layered chance in two frames, gain and loss. Zero framing was done here as well, in the same way as before. The expected values in both options have been kept the same, so the framing is the only difference.

Which one of the given choices would you prefer? *

- ☐ A sure gain of 8000 rupees
- ☐ 20% chance to gain 24000 rupees and an 80% chance to enter a coin toss to either gain 8000 rupees or lose nothing

Figure 6: Question 1, Modified gain frame

Which one of the given choices would you prefer? *

- ☐ A sure loss of 8000 rupees
- ☐ An 80% chance to enter a coin toss to lose 8000 rupees or gain nothing and a 20% chance to lose 24000 rupees

Figure 7: Question 2, Modified loss frame

Question 3 and 4 made both alternatives double layered choices, however, these tested a different aspect of framing. Here, we made sure that the expected values of both alternatives are the same to ensure no other biases. One alternative included a possible chance to enter a gamble for a big gain with no loss, or to enter a gamble with a big gain and a big loss. The other alternative included alternatives with slightly lesser gains but small losses in both cases. This was done in both, the gain frame and the loss frame. The questions are shown below (Fig 8., Fig 9.).

The form for this experiment received 101 responses. All responses were used in analysis. These were all the questions we used, and the collected data is shown and analysed in the next section.

Which one of the given choices do you prefer? *

- ☐ A 50% chance to enter a coin toss to gain 400 rupees or lose nothing and a 50% chance to enter a coin toss to gain 600 rupees or lose 200 rupees
- ☐ A 50% chance to enter a coin toss to gain 500 rupees or lose 40 rupees and a 50% chance to enter a coin toss to gain 400 rupees or lose 60 rupees

Figure 8: Question 3, Gain frame

Which one of the given choices do you prefer? *

- ☐ A 50% chance to enter a coin toss to lose 400 rupees or gain nothing and a 50% chance to enter a coin toss to lose 600 rupees or gain 200 rupees
- ☐ A 50% chance to enter a coin toss to lose 500 rupees or gain 40 rupees and a 50% chance to enter a coin toss to lose 400 rupees or gain 60 rupees

Figure 9: Question 3, Loss frame

3. Results and Analysis

The results for all the conducted experiments are shown below.

3.1 Experiment 1 part 1

The results for experiment 1 part 1 (both forms combined) is given in tabular form below.

71 participants filled this form in total. So our null hypothesis for this problem would be around 35.5 for each option. We visualise the choices observed in the graphs below.

On performing the Chi-square analysis with these assumptions, we obtain the following results (Table 2).

Questions	Option 1	Option 2
Question 1	44	27
Question 2	29	42

Table 1: Results, Experiment - 1 part 1

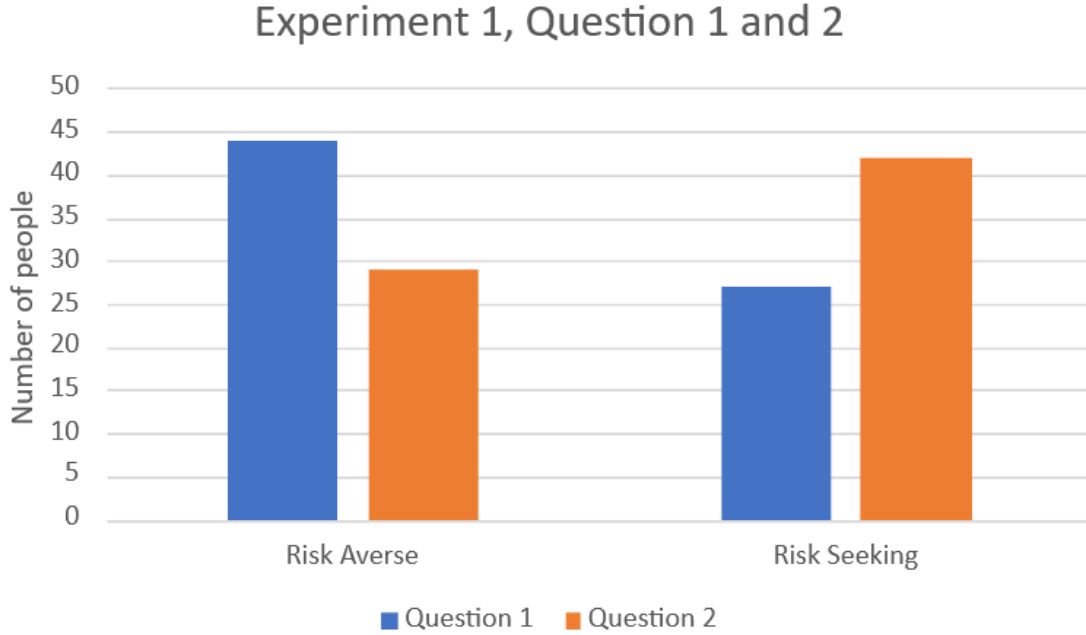


Figure 10: Number of people vs Choice taken bar plot, Experiment - 1

Questions	χ^2	p-value
Question 1	4.07	0.04364
Question 2	2.38	0.122875

Table 2: Chi-square analysis, Experiment - 1 part 1

The formula used for the chi square analysis for independence is shown below.

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i} \quad (1)$$

where O_i is the observed value and E_i is the expected value from the null hypothesis. p-values were calculated using Microsoft Excel's built-in Chi-square test function. The calculated p-values and Chi-square values clearly show us that the alternate hypothesis is different enough from the null hypothesis. Hence, we can conclude from the data that for the gain frame in question 1, people are being more risk averse towards the gain. This can be attributed to the prospect theory value function, and is expected. We do not see an overwhelming majority for the sure gain however, and this is what we can use to support the zero framing hypothesis, and attribute this factor to the lose nothing/gain nothing framing.

For question 2, we again observe people being risk seeking towards the loss, which is expected from the prospect theory value function. However, again, the distribution is not as skewed as we are led to believe from Kahneman's experiment, and this can also be attributed to the framing effect which we accomplish by phrasing zero as lose nothing/gain

Summary	Sum	Average	Variance
Version 1	251	22.81	784.76
Version 2	205	18.63	993.85

Table 3: One-way ANOVA Summary, Experiment - 1, Question 3

nothing. So, we can conclude that the framing of zero does manipulate choices to a certain extent.

3.2 Experiment 1 part 2

For the results of this part of the experiment, a One-Way ANOVA was done using the XLMiner Analysis ToolPak extension available for Google Sheets. For performing a One-Way ANOVA, we require a dependent variable that is continuous, an independent variable that is categorical and a random sample of data from the surveyed population. Our continuous variable is a weighted value for bet attractiveness and the scale value for Question 3, and a weighted value for the happiness of the bet and the scale value for Question 4, each measured by a separate Likert scale. The rationale behind the weighted value is to take the value on the scale into account. Our independent variable is the different framing questions we have asked in each versions of our experiment.

The results for Question 3 are presented in Table 3 and 4.

The variance plots for question 3 are also shown below.

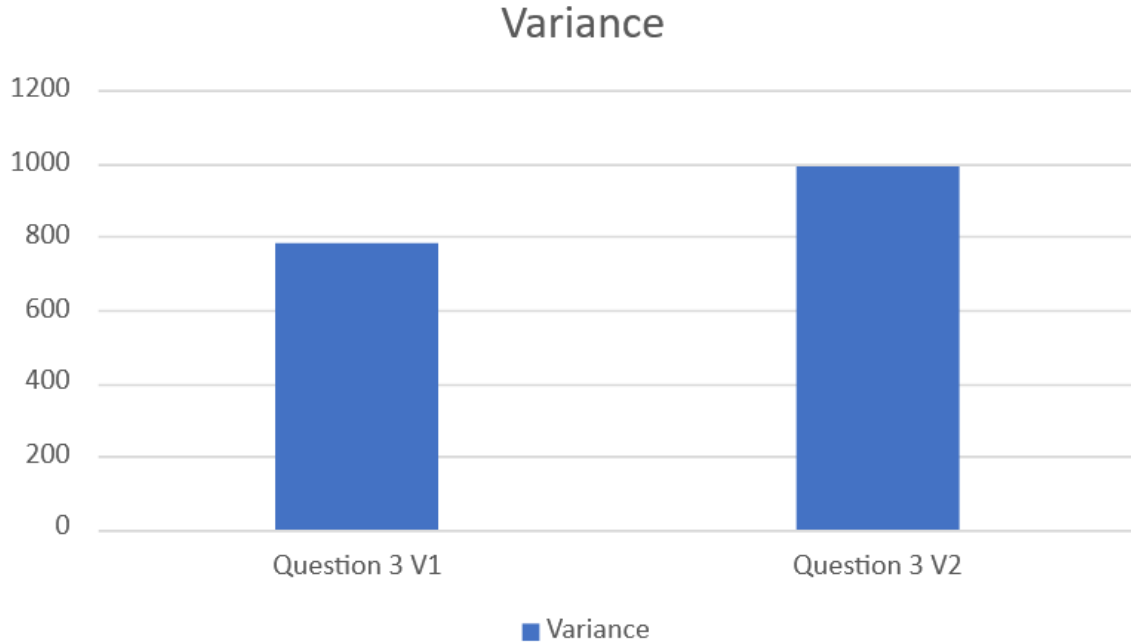


Figure 11: Question 3 variance analysis, v1 and v2

Source of Variation	SS	MS	F	P-value	F crit
Between Groups	96.18	96.18	0.11	0.75	4.35
Within Groups	17786.18	889.31			

Table 4: One-way ANOVA Source of Variation, Experiment - 1, Question 3

Summary	Sum	Average	Variance
Version 1	236	21.45	639.67
Version 2	178	16.18	437.56

Table 5: One-way ANOVA Summary, Experiment - 1, Question 4

The results for Question 4 are presented in Table 5 and 6. The variance plots for question 4 are also shown below.

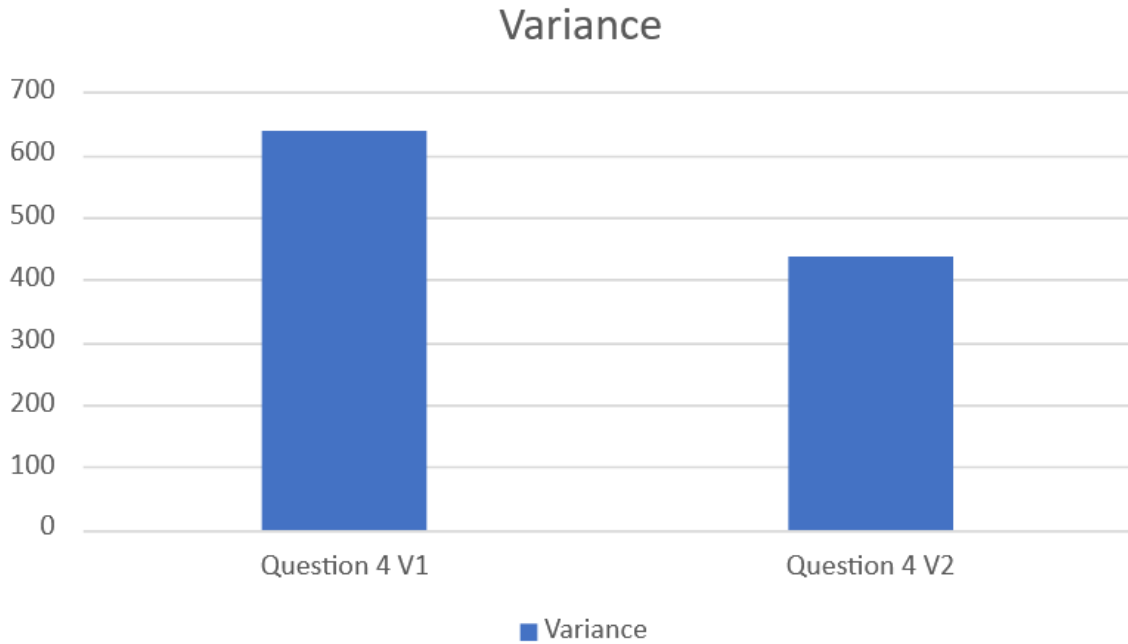


Figure 12: Question 4 variance analysis, v1 and v2

The important results obtained from the One-Way ANOVA for Question 3 is that we see the variance of the choice is much higher in the lose 5 rupees condition compared to the gain nothing condition, with a higher proportion of people choosing higher values of

Source of Variation	SS	MS	F	P-value	F crit
Between Groups	152.91	152.91	0.28	0.60	4.35
Within Groups	10772.36	538.61			

Table 6: One-way ANOVA Source of Variation, Experiment - 1, Question 4

Questions	Option 1	Option 2
Question 1	47	54
Question 2	55	46
Question 3	26	75
Question 4	61	40

Table 7: Results, Experiment - 2

attractiveness (>5) (84% people selected a high bet attractiveness for lose 5 rupees compared to 60.53% for gain nothing).

We see that the results for Question 4 are also following the conclusions reached by Wardley and Alberhasky (2021), with a higher proportion of people choosing high values of happiness (>5) in the lose 5 rupees condition compared to the gain nothing condition (75% people selected a higher value for happiness for lose 5 rupees compared to 52.77% for gain nothing). The values for variance are inconsistent with the findings of the previous question due to a larger number of people choosing the median value on the scale for Question 4 rather than Question 3 (11.62% and 7.41% for Question 3 compared to 16.28% and 25.92% for Question 4 in the gain nothing and lose 5 rupees conditions respectively).

Although the values are slightly skewed due to the nature of the responses in our experiment, we have been able to replicate the experiment conducted by Wardley and Alberhasky (2021) successfully. A note on the experiment by Wardley and Alberhasky (2021) is that the metric for evaluating happiness or the "positive effect" is distorted to some extent. They have attempted to objectively assess the happiness of the bet using a Likert scale, assuming that every participant would scale their emotions in the same way. This is slightly presumptuous in nature and an alternative solution is to ask the participant to write a short paragraph on their feelings on the bet. A consequent sentiment analysis on the paragraphs could have given a better objective score and would also include the subjectivity of emotions that should be considered in the experiment.

3.3 Experiment 2

The results for this experiment are shown in Table 7.

101 participants filled this form in total. So our null hypothesis for this problem would be around 50.5 for each option. The visualisation of these results in graphical form are

Questions	χ^2	p-value
Question 1	0.485	0.486099
Question 2	0.802	0.370502
Question 3	23.772	1.08E-06
Question 4	4.366	0.036656

Table 8: Chi-square analysis, Experiment-2

given below. On performing the Chi-square analysis with these assumptions, we obtain the following results.

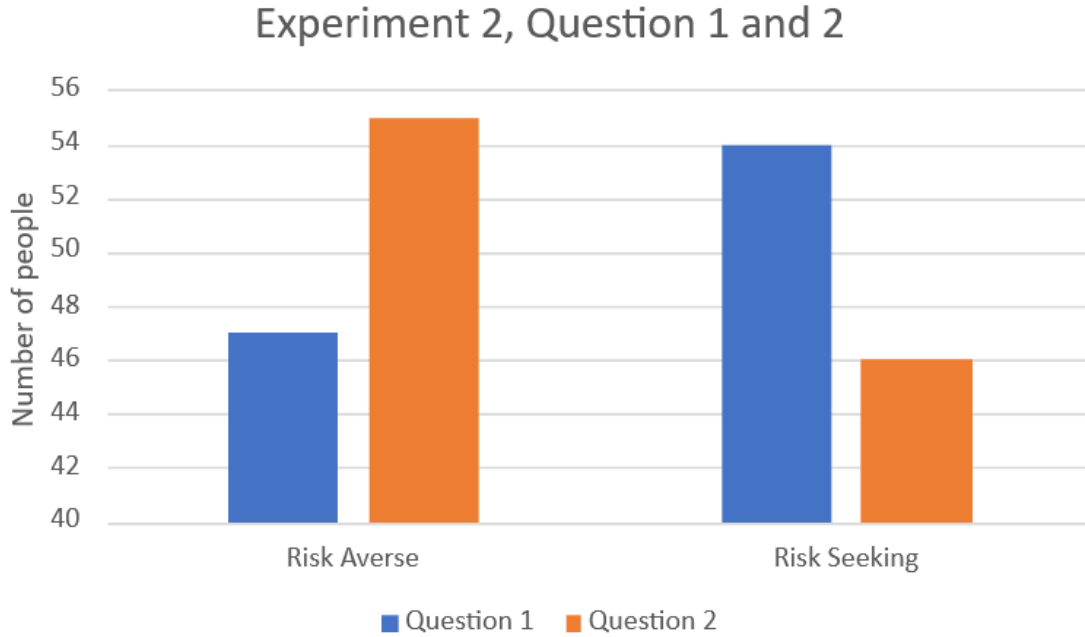


Figure 13: Experiment - 2 , Question 1 and 2, People vs Choices

The formula used for the chi-square analysis for independence is the same as the one used in the analysis of experiment 1 part 1. p-values were calculated using Microsoft Excel's built-in Chi-square test function. For the first and second questions, we observe a low chi square value and a high p value, implying that the Null hypothesis (equal people per option) is not entirely wrong, and cannot be rejected. We observe much higher Chi-square values for the data obtained in questions 3 and 4, which implies that the Null hypothesis is wrong in this case. A lot more people clearly tend to pick the smaller individual losses option in the gain frame, and the larger lump gain in the loss frame, which goes towards showing that they are risk averse in the gain frame while being risk seeking in the loss frame. Another interesting aspect of this is that we observe people to prefer a higher probability for small losses in the option 2 as compared to the relatively very small chance for a large loss in option 1, even when juxtaposed with the chance to lose absolutely nothing and only stand

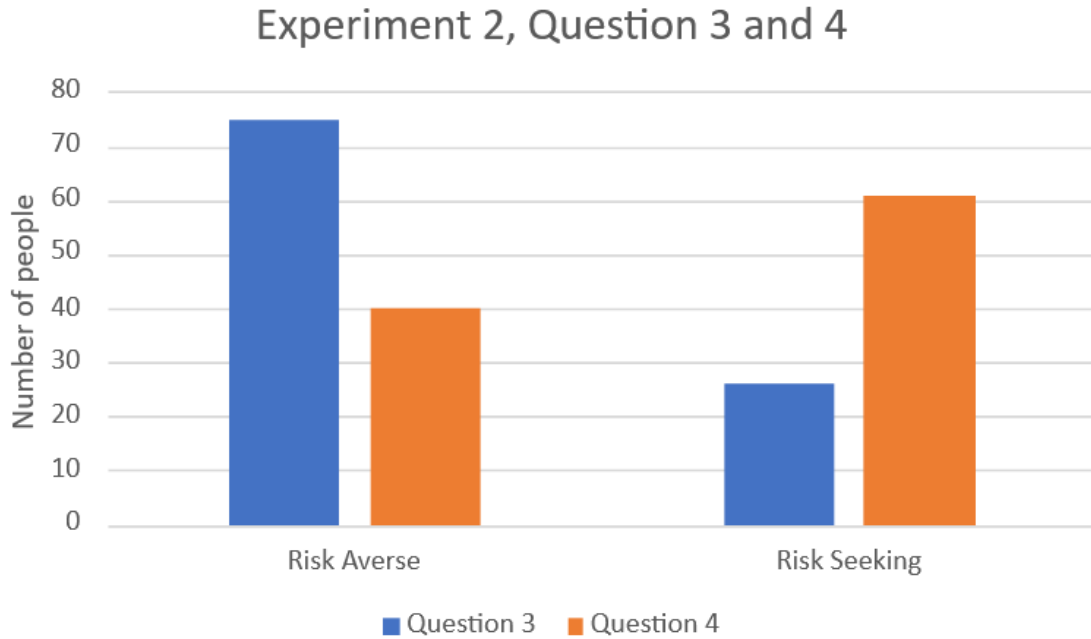


Figure 14: Experiment - 2 , Question 3 and 4, People vs Choices

to win. Zero framing was performed here, however it appeared to have no effect as people still picked the small losses over the lose nothing framing, which leads us to believe **the findings of the modified Bateman’s study are not very objective or conclusive but they are still indicative of a bias that is created because of the framing effect.**

4. Conclusions

The studies were conducted successfully and the results were analysed objectively. Our findings do concur with the reference paper on a surface level and indicate a correlation between the choices made and the way zero is framed, along with the framing effect in general. More of the effects we observe are leaning towards being just because of the framing than purely and solely because of the way zero is framed in the options. We can see the importance of giving reference points increases the attractiveness of a choice through the replicated Bateman’s experiment, while the framing of such an anchor would be paramount in the final results. While the zero framing bias is seen clearly in Kahneman’s experiment, we do not observe it having much of an effect in our experiments or in Bateman’s experiment, which leads us to the conclusion that zero framing will play a dominant role only when the choices are presented in an uncomplicated and simple way, to help them stand out and act as a default reference point for analysing the rest of the question.

We also observe from our results in experiment 2 that people will always be risk seeking with losses and risk averse with gains at a broad scale. However, we also observe that people will prefer definite small losses over the small chance of a large loss, even when presented

with very compelling situations. Thus, the prospect theory value function is a relatively accurate model of our valuation system and our studies are yet another testament to their success.

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