



INFLUENCE OF CHOICE DOMAINS ON EXPLORATORY SEARCH

▼ Research Questions

1. Do participants explore the options more if the gambles involved losses rather than gains? Do the average run sizes for each participant within each block differ for losses and gains?
2. Do deliberation lengths (i.e., response times) differ between gambles with losses and gambles with gains? Do participants deliberate more when exploring gambles involving losses compared to gambles involving gains?
3. Furthermore, if participants were presented with gambles involving losses before gambles involving gains, does the tendency of over-exploration in the loss domain carry over to subsequent choices between gambles that involved gains? Is the reversed pattern found if participants were presented with gambles involving gains before those involving losses?
4. Do individual differences in searching behaviours relate to participants' attentiveness when making these choices?

5. In the original paper, each option only led to no more than two possible monetary outcomes. In my study, I will change the payoff distributions to continuous distributions and investigate if the original results generalise.

▼ Plan



Sample between the two options for 100 trials before making the final choice. Partial feedback will be shown after each trial. The sampling will not affect the resulting points however, the final choice will. You will have to complete 2 such tasks. Your choices during sampling and the final choice will be recorded. Your response time will also be recorded.

- For the first and second questions, the plan is to divide participants into the loss and gain domain (sampling paradigm) and record their responses and response times. The results would follow the principle of win-stay and lose-shift (Thorndike, 1911). Slower response time in the loss domain should indicate more attention to losses. I'm not sure if response time alone would be sufficient to test loss attention. However, I will try and find something more conclusive (like, heart rate, eye tracking, pupil dilation and so on, although I am currently not sure how to test for those).
- For the third question, the plan is an extension of the above. Participants would be divided into two groups where they would be shown the loss task first, followed by the gain or the gain task first, followed by loss. The search behaviour in the first task would carry forward in the following task due to “house money effect” (increased risk seeking in the presence of a prior gain) and “break-even effects” (in the presence of prior losses,

outcomes which offer a chance to break even are especially attractive) (Thaler & Johnson, 1990).

- For the fourth question, a break in between tasks should override the house money and break-even effects. I have not yet come up with a distraction to add between the loss and domain tasks. However, the plan is to introduce this distraction during the experiment and compare the results with the experiment where no distractions were introduced. I have also thought about the effect of shorter and longer distractions on the search behaviours of the participants. I am not one hundred percent sold on this idea yet. I need to think a lot more about the same.

▼ Project Description

Introduction

Many researchers have argued that the effect of loss on searching through multiple choices can be attributed to loss aversion, a cognitive bias where the pain of loss is greater than the pleasure of gains. However, many others have proved that loss aversion alone cannot explain this effect (Hochman & Yechiam, 2011). Through this research we can determine the effect of loss and gain outcomes on the participants' behaviour of shifting through options and their reaction times.

Research Question

This project aims to replicate Study 1 in Yechiam, Zahavi & Ardit (2015) with a few extensions. Yechiam, Zahavi & Ardit (2015) found that when choosing between gambles, participants explored the options more if the gambles involved losses rather than gains. Furthermore, if participants were presented with gambles involving losses before gambles involving gains, the tendency of over-exploration in the loss domain tended to carry over to subsequent choices between gambles that involved gains. The reversed pattern was found if participants were presented with gambles involving gains before those involving losses. I aim to replicate these findings in our study using this paradigm. The additional research questions I am examining through this project are:

1. Do deliberation lengths (i.e., response times) differ between gambles with losses and gambles with gains? Do participants deliberate more when exploring gambles involving losses compared to gambles involving gains?

2. Do individual differences in searching behaviours relate to participants' attentiveness when making these choices?
3. In the original paper, each option only led to no more than two possible monetary outcomes. In my study, I will change the payoff distributions to continuous distributions and investigate if the original results generalise.

Research Method

In this study, which will last for about 15-20 minutes, participants will complete a multiple-block choice game. At the beginning of each block, they will start with a certain number of tokens. They will then be presented with two gambles and will choose between the two gambles repeatedly. The payoff distribution of each of the two gambles is pre-determined and fixed in each block, but these distributions will not be revealed to participants in advance. Once the participant has chosen a gamble, a payoff will be sampled from the option's payoff distribution and shown to participants. There are 50 trials in each block, and participants can choose whichever gamble they prefer in each trial (e.g., repeatedly choosing the same gamble or alternating before the gambles) in 50 trials. The number of tokens participants have at the end of each block will determine their bonus payment. Since the experiment takes only 15-20 minutes, participants will receive the base amount of £2 with additional payments up to £2. If the tokens are negative, the participants will not receive any additional payments.

Participants will be recruited through Prolific and will be randomly allocated to two conditions. In the gain-loss condition, blocks that involve gambles with gains will come first, followed by blocks that involve gambles with losses. In the loss-gain condition, participants will complete the blocks in the reversed order. The participants' choices during the trial of the task and the response times for each task will be recorded during the study. The outcome of their choices will be reflected on the tokens.

To measure the participants' attention to losses, participants will be asked to fill a questionnaire after the experiments where they will give the closest value or range to the outcomes of some of the gambles. By comparing the answers to the actual distribution of the gamble payoffs, I can determine whether participants paid careful attention to the tasks and remembered the payoffs. The participants will not be told about this beforehand. There is no bonus payment for the above.

▼ Experiment

1. Divide the participants into 4 groups (participants will be allocated to the groups randomly and they will not know which group they are in)

2. Each group gets 2 choice tasks (Loss-Gain, Gain-Loss, Loss-Distraction-Gain, Gain-Distraction-Loss)
3. Each task consists of 100 trials (sampling paradigm) and a final choice
4. Loss task contain only loss gambles and the gain task contains gain gambles (participants will not be aware which tasks they will be given)
5. The final outcome of each task contributes to the points acquired
6. Every 100 points converts to £1
7. Participants are paid a base rate of £6.5/hr with additional incentives of upto £2 which depends on the points acquired
8. The study should not take more than 30 minutes
9. Record
 - a. sampling choices for all 100 trials in each task
 - b. response time for each trial
 - c. final choice of each task
10. Calculate
 - a. Run sizes (consecutive selection of one option)
 - b. Average response time for each task
11. Compare
 - a. Run sizes among groups and tasks
 - b. Response time among groups and tasks
12. ANOVA
 - a. Main effects: Choice Domain and Order of the Domain
 - b. Interaction effect

▼ Debrief

Thank you for your participation in this experiment. This study aims to understand the differences in people's behaviour of searching through options when faced with losses or gains, to what extent individuals who explore the loss domain more intensively are more

attentive to the choice options, the lasting effect of the search behaviour in the loss domain carried forward in the gain domain and vice versa, along with the effect of loss of attention on people's lasting effects on the search behaviour.

If you have questions about this study, please contact Sarah Joseph at
Sarah.Joseph@warwick.ac.uk.

Finally, Data collection for this study is still on-going. Please do not share specifics of this study with anyone. If you are asked about this experiment, you can use the nondescript phrase like "it was fun" or "it was interesting".

Thank you!

▼ Code

JSPSYCH

▼ Literature Review

-  [Loss Restlessness and Gain Calmness: Durable Effects of Losses](#)
-  [How Choice Ecology influences Search in Decisions from Experience](#)
-  [How the Threat of Losses Make People Explore more than the Promise of Gains](#)
-  [Testing a micro-genesis account of longer form reinforcement learning](#)
-  [Loss Aversion in the Eye and in the Heart: The Autonomic Nervous System's Responses to Losses](#)
-  [Loss Aversion or Loss Attention](#)
-  [The Attention-Aversion Gap](#)

▼ Background

-  [The description-experience gap in risky choice](#)
-  [Task complexity moderates the influence of descriptions in decisions from experience](#)
-  [All frames are not created equal: A typology and critical analysis of framing effects](#)
-  [A Choice Prediction Competition: Choices from Experience and from Description](#)

-  [Framing effects and Risk Sensitive Decision Making](#)
-  [Computational mechanisms for context-based behavioral interventions: A large-scale analysis.](#)
-  [The Role of Framing Effects in Performance on the Balloon Analogue Risk Task](#)

▼ Notes

- ▼ Importance of Search as Behavioural and Cognitive Process (Lejarraga, Hertwig, Gonzalez, 2012)
 1. people tend to rely on fairly small samples—ranging mostly from 11 to 19 draws, amounting to nearly 7 ± 2 draws from each distribution—thereby attenuating the impact of rare events (see Hau, Pleskac, & Hertwig, 2010, Table 1)
 2. people respond to incentives such that increasing the monetary stakes substantially boosts sampling efforts (Hau, Pleskac, Kiefer, & Hertwig, 2008)
 3. small samples amplify the difference between the expected average earnings, thus making the options more distinct and choice easier (Hertwig & Pleskac, 2008, 2010)
 4. people's short-term memory capacity is positively correlated with the size of the drawn sample($r = .36$; Rakow, Demes, & Newell, 2008)
 5. people endowed with high numeracy draw larger samples than those with low numeracy (Lejarraga, 2010)
 6. people who report to have a high ability in rational thinking draw larger samples than those with low ability (Lejarraga, 2010)
 7. people tend to adopt one of two idealized search policies (piece-wise vs. round-wise search strategy, with the former involving more switching between options), with switching frequency being negatively correlated with sample size ($r = .44$) and positively associated with a decision strategy conducive to rare events being underweighted (Hills & Hertwig, 2010)
- ▼ Mapping the psychology of search in decisions from experience (Lejarraga, Hertwig, Gonzalez, 2012)
 1. cognitive properties of the decision maker (e.g., short-term memory capacity, rational abilities, search policies)

2. the properties of the choice ecology (e.g., loss vs. gain domain)
3. the interaction of ecology and cognition (e.g., amplification effect; Hertwig & Pleskac, 2010)

▼ Do Losses invoke more search than Gains (Lejarraga, Hertwig, Gonzalez, 2012)

- Negative experiences have greater influence on the individual than positive experiences (see Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Rozin & Royzman, 2001; Vaish, Grossmann, & Woodward, 2008)
- Studies of decisions under certainty similarly showed that the threat of losing a potential reward has larger effect on performance than the promise of gaining the same reward (Costantini & Hoving, 1973; Ganzach & Karsahi, 1995)
- Researchers have recorded more physiological arousal following negative events than following positive events (Bechara, Damasio, Tranel, & Damasio, 1997; Low, Lang, Smith, & Bradley, 2008; Satterthwaite, Green, Myerson, Parker, Ramaratnam, & Buckner, 2007; for related findings involving brain activity, see Tom, Fox, Trepel, & Poldrack, 2007)
- The most well known explanation for the effect of losses on performance is that performers are driven to avoid potential losses implicated in failure because of loss aversion (Kahneman & Tversky, 1979), the notion that losses have greater subjective weight than equivalent gains.
- Findings indeed show that losses trigger autonomic arousal, as evidenced by increased pupil diameter and heart rate following losses compared to respective gains (Hochman & Yechiam, 2011; Löw, Lang, Smith, & Bradley, 2008; Satterthwaite et al., 2007)
- Loss aversion (Tversky & Kahneman, 1992) : people are more sensitive to the possibility of losing objects or money than they are to the possibility of gaining the same objects or amount of money
- Endowment Effect (Kahneman, Knetsch, & Thaler, 1990; Thaler, 1980) : the behavioral tendency to value an item that one already owns substantially more than an identical item that is available for purchase
- Status Quo Bias (Samuelson & Zeckhauser, 1988) : people show a disproportionate preference for choices that maintain the status quo

- “Losses lead to heightened autonomic responses, compared to equivalent gains (as indicated by pupil dilation and increased heart rate) even in situations where the average decision maker exhibits no loss aversion” (Hochman & Yechiam, 2011, p. 140, and the review herein).
- On a physiological level, losses appear to trigger increased autonomic arousal relative to equivalent gains (Gonzalez, Dana, Koshino, & Just, 2005), consistent with the interpretation that losses signal the presence of a threat
- If search is aligned with the physiological level, then the prospect of a loss will likely trigger more search than that of a gain.
- Searching more → gauge the payoff distribution and the risk of a loss more accurately
- If search, however, is aligned with the final choice—and behavioral choice is less responsive to the threat of loss than our physiology—then the risk of a loss will not necessarily invoke more search than the chance of a gain.

▼ Attention-Aversion Gap

- Ert and Erev (2013) were among the first to note the empirical inconsistency of findings on loss aversion in decisions under risk (situations with feedback and situations with a clear and safe status quo are situations where loss aversion is unlikely to occur)
- In the review conducted by Yechiam and Hochman (2013b), none of the 13 studies examining decisions from experience found evidence for loss aversion
- The prospect of a loss increases attention more than the prospect of an equal gain as distinct from loss aversion.

▼ Exploratory search in decisions from experience

- Search behavior in the sampling paradigm is not incentivized directly, but only indirectly via the final choice a person makes
- Choice domain has a discernible impact on exploratory search in decisions from experience
- One objection to this loss-gain exploration asymmetry is that, as pointed out earlier, search itself was not directly incentivized, but only subsequent choice. Therefore, it

is unclear to what extent the asymmetry will generalize to situations in which search exacts immediate costs

- Yechiam, Zahavi, and Ardit (2015) → two options with same expected value with symmetric gambles → on average, there were higher alternation rates in the loss than in the gain domain.
- “the loss–gain exploration asymmetry does not predict or translate into loss aversion in choice.”

▼ Why does asymmetry in exploration emerge

- In decisions from experience people face uncertainty (or ambiguity, a term more commonly used in the economics literature)
- Exploration is the process by which they learn about the outcome space and relative frequencies, thus reducing uncertainty.
- Aspiration levels as stopping rules → Simon (1956)
- The Minimax Rule → Wald (1945; see also Savage's, 1954, maximin rule)

▼ Loss Restlessness and Gain Calmness

- Principles of win-stay and lose-shift (Thorndike, 1911): The tendency to repeat actions that produced positive feedback, and, to change actions that produced negative feedback
- Yechiam, Zahavi & Ardit (2015, p. 1102) identified gain-calmness as the “decreased choice switching following prior tasks producing gains” and loss-restlessness as the “increased tendency to switch choices following prior tasks with losses.”
- They represent carryover effects between tasks whereby the degree of historic success or failure produces shockwaves that determine future performance (Asad & Dyson, 2021)
- Loss increases attention → decision makers seek out different possibilities → more switching between choice options
- Schneider (1992) suggested that when the outcomes are predominantly in the loss domain, there is greater difficulty to make a decision and greater conflict, due to the

fact that none of the expected outcomes for the different options are likely to satisfy one's aspiration → more choice switching with losses

- Alternatively, the sustained effect of losses on choice switching may be due to an “unclosed mental account” in a task that involves mostly losses (Thaler, 2008; Nicolausco & Payne, 2014).
- This interpretation is similar to the Zeigarnik effect, the notion that people remember uncompleted tasks better than completed tasks, and are more inclined to invest further effort on these tasks (Zeigarnik, 1927; Ovsiankina, 1928; Condry, 1977)
- Such a long-term effect of past losses may be driven by the “break-even” effect (Thaler & Johnson, 1990) whereby people who have experienced a loss are more likely to choose an uncertain option if it offers the chance to erase the past loss.
- Gain calmness → Effects of prior gains are well known in the decision making literature, with a prominent example being the “house money” effect (Thaler & Johnson, 1990), the tendency to exhibit more risk taking given prior earnings
- If the same decision maker encounters positive outcomes in the gain domain, which no longer trigger the goal of preventing the worst as encountered in the loss domain, one may expect explorative efforts to be less exhaustive than in the actual loss domain (where the minmax principle ruled)

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