

Between Rational Intentions and Irrational Reactions: A Behavioral Study of Crisis Framing

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Abstract: This paper compares the classic Asian Disease Problem by Tversky & Kahneman (1981) with COVID-19 to examine decision-making in crises through the lens of Prospect Theory. The study investigates two factors, diminishing sensitivity and framing effects, by testing whether decisions shift when comparing the pandemic situations across different population sizes and whether gain versus loss framing significantly influences the decisions made by participants. The questionnaire was constructed with controlled variations in both population size (ranging from 600 to 6,000,000 individuals) and framing (gain vs. loss). Statistical analyses found no link between population size and choices, providing no evidence for diminishing sensitivity. However, framing had a significant impact on both scenarios: participants responded differently to gain- and loss-framed options, supporting Prospect Theory. The findings underscore the strong psychological influence of framing in public health crises.

Keywords: Prospect Theory, Framing Effect, Diminishing Sensitivity, Asian Disease Problem, COVID-19

1. INTRODUCTION

The COVID-19 pandemic not only challenged global healthcare systems but also exposed limitations in human decision-making under uncertainty. Individuals were required to interpret rapidly changing information about infection rates, mortality risks, and policy measures while making decisions under emotional stress and uncertainty. Such conditions highlight the limits of traditional rational choice models, which assume that individuals evaluate risks objectively and make decisions based on stable preferences (Kahneman, 2003). Behavioral economics provides a more realistic framework for understanding such decisions, as it incorporates psychological factors that influence how individuals perceive risk and uncertainty (Kahneman, 2013; Kahneman & Frederick, 2007).

Prospect Theory, developed by Kahneman and Tversky (1979), proposes that individuals evaluate outcomes relative to a reference point rather than in absolute terms. Decisions are shaped by loss aversion, diminishing sensitivity, and probability weighting. One of the most robust findings derived from the theory is the framing effect, which demonstrates that logically equivalent options can lead to different choices depending on whether outcomes are framed as gains or losses (Tversky & Kahneman, 1981).

This paper builds on these theoretical foundations by comparing the classical Asian Disease Problem (ADP) with a real-world adaptation based on COVID-19. It investigates whether framing

effects remain stable in emotionally salient contexts and whether increasing population sizes influence decision behavior, as predicted by diminishing sensitivity.

1.1. Research Objectives

The primary objective of this study is to examine two central psychological drivers of decision-making under crisis conditions. First, it investigates whether positive versus negative framing significantly influences individual choices. Second, it analyzes whether decision-making shifts when the number of affected individuals increases from hundreds to millions. By combining a classic experimental paradigm with a real pandemic scenario, this research aims to assess the robustness of Prospect Theory in a contemporary context.

1.2. Theoretical Background

Prospect Theory describes decision-making as a two-stage process consisting of an editing phase and an evaluation phase (Kahneman & Tversky, 1979). During the editing stage, individuals organize and simplify available prospects, whereas in the evaluation stage they assess these prospects and select the option with the highest subjective value (Kahneman & Tversky, 1979).

Central to the theory is the S-shaped value function, which is concave for gains and convex for losses (Kahneman & Tversky, 1979). This functional form reflects the principle of diminishing sensitivity, according to which the psychological impact of changes decreases as their magnitude increases (Kahneman & Tversky, 1979; Kahneman, 2013). For example, the difference between 100 and 200 is perceived as more significant than the difference between 1,100 and 1,200 (Kahneman & Tversky, 1984). Additionally, loss aversion implies that losses loom larger than gains of equal objective size. Figure 1 illustrates this S-shaped value function, showing the asymmetry between gains and losses and highlighting the steeper slope for losses compared to gains.

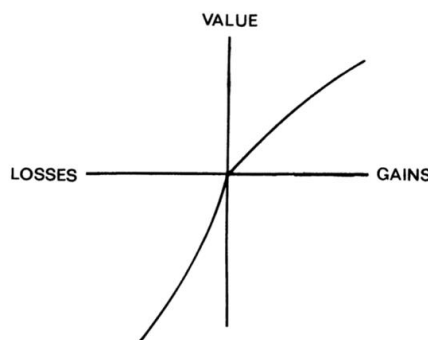


Figure 1: A hypothetical Value Function (Source: Kahneman & Tversky, 1979)

In large-scale crises, diminishing sensitivity may lead to what Slovic (2007) calls “psychic numbing,” where emotional responses fail to scale proportionally with increasing numbers of victims. Testing this prediction within the context of pandemic decision-making provides important theoretical and practical insights.

In addition to the value function, Prospect Theory incorporates a probability weighting function, denoted as $w(p)$, which captures how individuals subjectively transform objective probabilities (Kahneman & Tversky, 1979). Rather than treating probabilities linearly, individuals systematically distort them because small probabilities tend to be overweighted, while moderate and high probabilities are typically underweighted (Tversky & Kahneman, 1992). This distortion helps explain why individuals may simultaneously engage in behaviors such as purchasing lottery

tickets while also buying insurance. Figure 2 visualizes this inverse S-shaped weighting function, demonstrating how subjective probability perception deviates from objective probability values.

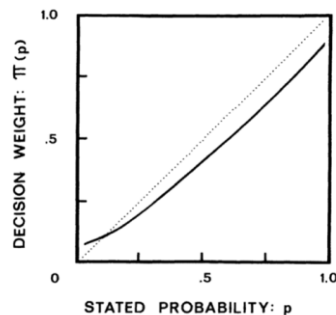


Figure 2: A hypothetical illustration of a weighting function (Source: Kahneman & Tversky, 1979)

2. THE ASIAN DISEASE PROBLEM AND COVID-19

2.1. The Asian Disease Problem

The Asian Disease Problem, introduced by Tversky and Kahneman (1981), presents participants with a hypothetical outbreak expected to kill 600 people. Two programs are offered with different outcomes: one certain and one probabilistic (Tversky & Kahneman, 1981). These programs are then framed either positively or negatively. This information is summarized in Table 1, which illustrates the structure of the decision problem used in the original experiment by Tversky & Kahneman, 1981.

Options	two programs to choose from
Outcomes	Number of people surviving/not surviving
Probabilities	second program always includes a probability
Framing	“will be saved” and “will die”

Table 1: Decision Problem in the Asian Disease Scenario (Based on Kahneman & Tversky, 1981)

The Asian Disease Problem concluded that when outcomes are framed positively in terms of lives saved, participants tend to prefer the certain option. However, when framed negatively in terms of lives lost, they tend to prefer the risky option. Despite the mathematical equivalence of the options, preferences systematically reverse depending on framing. Figure 3 illustrates this phenomenon by comparing the gain frame (“lives saved”) and loss frame (“lives lost”) used in the Asian Disease Problem, demonstrating how identical outcomes can produce opposite risk preferences (Rothman & Salovey, 1997; Tversky & Kahneman, 1981).

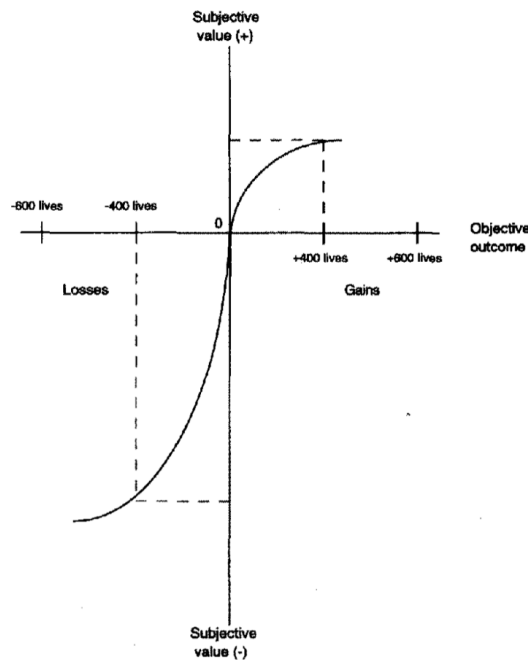


Figure 3: Gain and Loss Frame in the Asian Disease Problem (Source: Rothman & Salovey, 1977)

2.2. COVID-19

In this study, the COVID-19 scenario serves as a real-world adaptation of the ADP framework. The core decision structure of choosing between a certain and a probabilistic program was preserved, while the disease context was updated to reflect the COVID-19 pandemic. This adaptation allows for the examination of whether classical framing effects remain stable when individuals evaluate decisions within a socially and emotionally meaningful environment. Prospect Theory predicts that framing effects should persist regardless of context because they are rooted in the structure of the value function and loss aversion (Kahneman & Tversky, 1979). However, emotionally salient crises may intensify cognitive biases rather than attenuate them (Kahneman, 2013).

Furthermore, the COVID-19 condition enables the empirical testing of diminishing sensitivity across substantially larger population sizes. According to Prospect Theory, the psychological impact of numerical differences decreases as magnitudes increase (Kahneman & Tversky, 1979). By varying population sizes from hundreds to millions, this study examines whether numerical scaling influences risk preferences differently in the real-world COVID-19 pandemic context compared to a hypothetical scenario. Table 2 examines previously completed studies, that also adapted the ADP framework to COVID-19.

	Tversky & Kahneman 1981	Kühberger 1998	Bless et al. 1998	Diederich et al. 2018	Peterson & Tollefson 2023
Number of Subjects	N= 207	N= nearly 30.000	N= 118	N= 55	N= 1,021
Groups	students at Stanford University and the University of British Columbia	primarily student samples, but not in all the 136 studies	students at the Universities of Heidelberg & Mannheim	students at the Jacobs University Bremen	utility customers in Utah with diverse demographics
Compensation	-	-	-	3.00€ per session 7.00€ endowment	-
Primary objective of study	examine how different framing of equivalent choices influence decision-making	assess the overall impact of framing on risk decision-making and identify factors influencing the framing effect	whether presenting the ADP as a medical decision problem or a statistical problem would impact risk preferences	whether the need and type of disease play a role in the decision-making	whether framing effects influence risk preferences in climate change decision-making
Method	controlled experiments involving hypothetical problems to choose from	meta-analysis of 136 studies, calculating 230 effect sizes using statistical measures to compare framing effects	controlled experiment where students solved the ADP in a gain or loss frame, with medical or statistical research design	three types of diseases (unusual infection, leukemia, AIDS), four basic numbers of affected people and differences in time	application of the ADP model to climate related risks in form of a climate change scenario
Main Findings	the way options are framed influences choices, individuals tend to be risk averse in gain framed scenarios and risk-seeking in loss-framed ones.	overall framing effects were small-to-moderate, stronger for reference manipulation, choice, and single risk events	a usual framing effect occurred in the medical research context, but disappeared in the statistical context	the framing effect was stronger under short time constraints, the type of disease and the need influenced it as well	risk aversion occurred in the gain frame and risk-seeking in the loss frame

Table 2: Summary of Key Studies on the Asian Disease Problem adapted to COVID-19 (Own illustration)

3. METHODOLOGY

This study employed a quantitative between-subjects experimental design to investigate how framing and population size influence decision-making in crisis situations. Quantitative experimental approaches are widely used in behavioral decision research because they allow for specific variables to be isolated and statistically examined regarding their effects on individuals' choices (Field, 2013; Kahneman & Tversky, 1981). In the present study, the design closely follows the structure of the original Asian Disease Problem experiment while adapting it to include the COVID-19 pandemic context.

Data was collected through a structured online questionnaire distributed to Austrian university students. The final sample consisted of 203 valid responses, a sample size comparable to many experimental studies examining framing effects in decision-making (Kühberger, 1998). Participants were recruited through online distribution channels and completed the survey anonymously. Participants were randomly assigned to one of ten experimental conditions. These conditions were created by systematically varying three independent variables. First, two scenario contexts were used: the original Asian Disease Problem and an adapted COVID-19 scenario. Second, the framing condition varied between a gain frame and a loss frame. Third, the population size was manipulated across five levels: 600, 6,000, 60,000, 600,000, and 6,000,000 affected individuals. Combining these variables resulted in ten possible scenarios, with each participant being exposed to only one scenario. Random assignment ensured that participants could not compare scenarios directly, thereby reducing potential bias.

In each experimental condition, participants were asked to choose between two programs designed to combat disease outbreak. One program represented a certain outcome (safe option), while the other represented a probabilistic outcome (risky option). This structure replicates the original decision format introduced by Tversky and Kahneman (1981), allowing the study to test whether the same cognitive mechanisms apply in both hypothetical and real-world pandemic contexts.

3.1. Hypotheses

To empirically examine the theoretical predictions of Prospect Theory, a total of six hypotheses (H1–H6) were formulated. These hypotheses were divided into two conceptual groups based on the theoretical mechanisms under investigation. The first group focuses on the principle of diminishing sensitivity, which predicts that individuals become less responsive to numerical differences as the magnitude of outcomes increases (Kahneman & Tversky, 1979). The hypotheses related to this concept are presented in Table 3, which outlines the expected relationship between population size and participants' risk preferences within and across the two scenarios.

Hypotheses for examining Diminishing Sensitivity	
H1,0:	There is no significant association between the population size (600, 6,000, 60,000, 600,000, and 6,000,000 people) and participants' choices in the Asian Disease Problem.
H1,a:	<i>There is a significant association between the population size (600, 6,000, 60,000, 600,000, and 6,000,000 people) and participants' choices in the Asian Disease Problem.</i>
H2,0:	There is no significant association between the population size (600, 6,000, 60,000, 600,000, and 6,000,000 people) and participants' choices in the COVID-19 Pandemic.
H2,a:	<i>There is a significant association between the population size (600, 6,000, 60,000, 600,000, and 6,000,000 people) and participants' choices in the COVID-19 Pandemic.</i>
H3,0:	There is no significant difference in diminishing sensitivity to population size between the Asian Disease Problem and the COVID-19 pandemic scenarios.
H3,a:	<i>There is a significant difference in diminishing sensitivity to population size between the Asian Disease Problem and the COVID-19 pandemic scenarios.</i>

Table 3: Overview of Hypotheses examining Diminishing Sensitivity (H1-H3)

The second group of hypotheses examines the framing effect, a central prediction of Prospect Theory stating that individuals tend to be risk-averse when outcomes are framed as gains and risk-seeking when outcomes are framed as losses (Tversky & Kahneman, 1981). These hypotheses test whether gain-framed and loss-framed scenarios produce significantly different choice patterns in both the Asian Disease Problem and the COVID-19 context. A structured overview of these hypotheses is presented in Table 4, which summarizes the null and alternative hypotheses used to statistically evaluate framing effects in the experiment.

Hypotheses for examining the Framing Effect	
H4,0:	There is no significant association between the framing of Program A ("will be saved") and Program C ("will die") and participants' choices in the Asian Disease Problem.
H4,a:	<i>There is a significant association between the framing of Program A ("will be saved") and Program C ("will die") and participants' choices in the Asian Disease Problem.</i>
H5,0:	There is no significant association between the framing of Program E ("will be saved") and Program G ("will die") and participants' choices in the COVID-19 Pandemic.
H5,a:	<i>There is a significant association between the framing of Program E ("will be saved") and Program G ("will die") and participants' choices in the COVID-19 Pandemic.</i>
H6,0:	There is no significant difference in the framing effect between the Asian Disease Problem and the COVID-19 pandemic scenarios.
H6,a:	<i>There is a significant difference in the framing effect between the Asian Disease Problem and the COVID-19 pandemic scenarios.</i>

Table 4: Overview of Hypotheses examining the Framing Effect (H4-H6)

The dependent variable in the study was the participant's choice between the safe and risky option. Because the data consisted of categorical choices, statistical analysis relied on chi-square tests for independence and goodness-of-fit. These tests are appropriate for nominal data and allow researchers to determine whether observed differences in response distributions across experimental conditions are statistically significant (Field, 2013). The analysis therefore examined whether population size and framing were significantly associated with participants' decision patterns across the different scenarios.

4. EMPIRICAL RESULTS

The empirical findings show no statistically significant association between population size and decision-making in either scenario. This was true for both the Asian Disease Problem (positive frame: $p = .705$; negative frame: $p = .709$) and the COVID-19 scenario (positive frame: $p = .620$; negative frame: $p = .982$). Participants' risk preferences remained relatively stable across all five population sizes. These results provide no empirical support for diminishing sensitivity. Even when the number of affected individuals increased dramatically, participants did not systematically adjust their risk behavior.

In contrast, framing effects were statistically significant in both scenarios. When outcomes were presented in a gain frame, participants predominantly chose the certain option ($p < .001$), demonstrating risk aversion. When outcomes were presented in a loss frame, participants were more likely to select the probabilistic option ($p < .001$), reflecting risk-seeking behavior. This pattern replicates the original findings of Tversky and Kahneman (1981) and is consistent with meta-analytic evidence demonstrating the robustness of framing effects in decision-making experiments (Kühberger, 1998). Interestingly, framing effects appeared slightly stronger in the COVID-19 scenario, primarily in the negative framing. This suggests that emotional relevance may amplify susceptibility to framing. However, the overall direction of the effect remained consistent across both contexts. Table 5 provides a summary of all hypotheses examined in this study.

Hypotheses for examining Diminishing Sensitivity		
H1,0:	There is no significant association between the population size (600, 6,000, 60,000, 600,000, and 6,000,000 people) and participants' choices in the Asian Disease Problem.	✓
H1,a:	There is a significant association between the population size (600, 6,000, 60,000, 600,000, and 6,000,000 people) and participants' choices in the Asian Disease Problem.	✗
H2,0:	There is no significant association between the population size (600, 6,000, 60,000, 600,000, and 6,000,000 people) and participants' choices in the COVID-19 Pandemic.	✓
H2,a:	There is a significant association between the population size (600, 6,000, 60,000, 600,000, and 6,000,000 people) and participants' choices in the COVID-19 Pandemic.	✗
H3,0:	There is no significant difference in diminishing sensitivity to population size between the Asian Disease Problem and the COVID-19 pandemic scenarios.	✓
H3,a:	There is a significant difference in diminishing sensitivity to population size between the Asian Disease Problem and the COVID-19 pandemic scenarios.	✗
Hypotheses for examining the Framing Effect		
H4,0:	There is no significant association between the framing of Program A ("will be saved") and Program C ("will die") and participants' choices in the Asian Disease Problem.	✗
H4,a:	There is a significant association between the framing of Program A ("will be saved") and Program C ("will die") and participants' choices in the Asian Disease Problem.	✓
H5,0:	There is no significant association between the framing of Program E ("will be saved") and Program G ("will die") and participants' choices in the COVID-19 Pandemic.	✗
H5,a:	There is a significant association between the framing of Program E ("will be saved") and Program G ("will die") and participants' choices in the COVID-19 Pandemic.	✓
H6,0:	There is no significant difference in the framing effect between the Asian Disease Problem and the COVID-19 pandemic scenarios.	✗
H6,a:	There is a significant difference in the framing effect between the Asian Disease Problem and the COVID-19 pandemic scenarios.	✓

Table 5: Summary of the examined hypotheses (Own illustration based on findings)

5. DISCUSSION

The findings of this study provide further evidence of the strong influence of framing effects in decision-making under crisis conditions. Consistent with the predictions of Prospect Theory, participants displayed risk-averse behavior when outcomes were framed as gains and risk-seeking behavior when outcomes were framed as losses. This pattern replicates the original findings of Tversky and Kahneman (1981) and aligns with previous meta-analytical research demonstrating the robustness of framing effects across a wide range of contexts (Kühberger, 1998).

One of the most notable results of the study is that framing effects remained present even when the scenario was adapted to a real-world pandemic context. The COVID-19 scenario produced decision patterns that were highly similar to those observed in the classical Asian Disease Problem. This suggests that the cognitive mechanisms described by Prospect Theory operate not only in hypothetical laboratory settings but also in real-world situations characterized by uncertainty and emotional salience. The slightly stronger framing effects observed in the COVID-19 condition may be explained by the increased emotional relevance of the pandemic, which likely made the scenario more personally meaningful to participants.

In contrast, the results did not provide empirical support for the concept of diminishing sensitivity. According to Prospect Theory, individuals should perceive differences in outcomes less strongly as numerical magnitudes increase (Kahneman & Tversky, 1979). However, the analysis showed no statistically significant changes in risk preferences across the five population sizes tested in the experiment. Participants reacted similarly whether the scenario involved hundreds or millions of affected individuals.

This finding may be explained by the concept of psychic numbing, which suggests that individuals struggle to emotionally process large numbers of victims (Slovic, 2007). When the scale of a humanitarian crisis becomes very large, emotional responses may plateau rather than increase proportionally with the number of affected individuals. As a result, decision-making may become insensitive to numerical magnitude, leading individuals to treat large population figures similarly regardless of their absolute size.

From a practical perspective, these findings have important implications for public communication during health crises. Policymakers and public health institutions frequently rely on statistical information to inform the public about risks. However, the results of this study suggest that the way information is framed may have a stronger influence on public decision-making than the numerical magnitude of the data itself. Framing strategies may therefore play a critical role in shaping public responses to health policies, vaccination campaigns, and risk communication.

6. CONCLUSION

This study demonstrates that framing effects remain a dominant factor in crisis decision-making, while population size does not significantly alter risk preferences. By comparing a classical experimental paradigm with a real pandemic context, the research confirms the predictive strength of Prospect Theory regarding framing while questioning the behavioral relevance of diminishing sensitivity in large-scale crises.

Ultimately, the findings suggest that human decision-making in crisis situations is shaped more by how information is presented than by the numerical magnitude of consequences. Understanding these psychological mechanisms is essential for designing effective communication strategies and improving decision-making processes in future public health emergencies.

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