

# Experimental Strategy for Investigating the Neural Basis of Framing Effects

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# Behavioral and Neural foundations of Framing Effects

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- 1 Project: Pin down framing effects in situation of risky choice
  - Object of interest: framing effects for risks
  - Questions
- 2 Behavioral data
  - Robustness of this type of framing effects
  - Violation of the invariance principle and irrationality
- 3 fMRI data
  - Capture a possible feeling of discomfort while realizing ex post one's inconsistency
  - Neural underpinnings of the moral act

## Risky choice type framing effects

- Subjects are asked to make a risky choice between two options that are presented in two different though logically equivalent fashion. → **Positive and negative frames.**
- Existing literature:
  - Kahneman and Tversky's famous «*Asian Disease*» problem: **risk aversion for gains - in the positive frame**, whereas **risk-seeking for losses - in the negative frame** → **Inconsistency result** achieved using a «*between-subjects*» design.
  - Sandra L Schneider (1992) fleshed out this result, using a «*within-subjects*» design, with several scenarios, not just the «*Asian-Disease*» story: **not a clear pattern for the negative frame**, while the risk aversion is confirmed for the positive frame.

## Aims

- The design used by Sandra Schneider might lack of robustness, because of a **potential carryover effect**: different scenarios presented to the subjects without filler tasks.
- Test Kahneman and Tversky's inconsistency result again by using another «*within-subjects*» design.
- Hypothesis to be tested: the violation of the invariance rule is due to an extrinsic (emotional-moral) factor: **broadened rationality hypothesis**; alternative hypothesis: «**Prospect Theory**» explanation.

## A multi-version of the «asian-disease problem»

- Run several trials by varying the degree of moral-emotional content of the scenarios: rate of death or live of humans, rate of failure or success of a commercial product.
- Use of a «*within-subjects*» procedure: each subject faces in turn the positive frame (henceforth PF) and the negative frame (NF) **with «filler» tasks** between frame pairs and between the different scenarios; this to try to **bypass the potential carryover effect**. ▶ Caveat
- For each problem, one risky option, versus the «sure choice».
- Look at the proportion of people making the risk averse choice in the PF and the proportion making the risk averse choice in the NF.

## Predictions

- We expect «*framing effect*» to be the most frequent pattern only in the most extreme scenarios; conversely the «softer» scenarios might be associated with steady preferences across the two frames (risk aversion).
- Possible explanation: people are basically risk averse, but there is a «*moral*» dimension guiding some decisions too.
- This experimental design rests on a **strong inference** reasoning: if prospect theory [resp. the competing hypothesis] is true then we won't [resp. will] observe **sensitivity to the emotional-moral content of the scenarios**.

## «Norm retrieval» test (1 out of 3)

- Zero in on the versions such that «framing effect» is the most frequent pattern - we predict «asian-disease» will be in this category; second step restricted to these cases.
- Test «the robustness» of this violation of the invariance rule, by making the latter directly accessible to the subject. → Sort of «**Revealed Preference Argument**», echoing Slovic and Tversky's «*Understanding/Accepting principle*»:
  - If framing effects stem from bounded rationality then **by making the rational rule accessible**, we should observe a **correction** of the framing effect.
  - Conversely, if the rational rule is **not used** as a guide by the subject, **while the rule is available**, this implies that the logical invariance principle is dominated.



## «Norm retrieval» test (2 out of 3)

- In practice: PF and NF are presented simultaneously; then **the experimenter informs the subject of the logical equivalence** through a purely descriptive speech. [▶ more detail](#)
- Then the subjects are asked **in this order**:
  - Does the average person judge that the two problems are equivalent according to you?
  - Do you judge that the two problems are equivalent?
- Rationale for this dual design: **Bypass a possible «persistence bias» in the response.** [▶ More detail](#)

## «Norm retrieval» test (3 out of 3)

- We are interested in the **reaction of a subject when realizing she was previously inconsistent.**
- A «*feeling of irrationality*» - «***epistemic discomfort***» - might exist.
- We envision to pin down such hypothetical feeling through an fMRI procedure.

## Epistemic discomfort

- We are currently running an experiment resting on the «*bat and ball*» cognitive defect - massive rate of error while performing the cognitive task. One of our aims is to **capture the feedback process when the subjects realize their error**.
- Using these fMRI data we might **recognize** in the FE experiment **the same** specific neural substrate(s) activated after realizing a cognitive defect.
- Sort of «***epistemic discomfort***» when one realizes she was inconsistent.
- Look at the **contrast between the subjects who corrected** their previous inconsistent choices, **and the steady profiles** (steadily inconsistent and steadily consistent).

## Two competing hypothesis to pin down the moral dimension

- If our competing hypothesis is true - sensitivity to the emotional-moral content of the task, which are **the mechanisms involved?**
- **Two alternative theories:**
  - A **purely emotional one** involving Dual Process Theory's automatic-experiential system - *S1* in Kahneman terms.
  - A **cognitive-based** one involving Dual Process Theory's analytical regions - *S2* in Kahneman terms.

# The emotional hypothesis

- Choice of the gamble in the negative frame stems from a «*gut feeling*».
- Sort of emergency signal: «*I can't do that!*».  
→ Specific activation of **limbic substrates** involving S1 should be observed when facing moral-content scenarios, vis-à-vis neutral ones.

## Morality as broadened rationality

- The alternative hypothesis: the **trade-off** between the two options is **more complicated** within the negative frame as compared with the positive frame:
    - Within the positive frame, risk aversion dominates the choice: evaluation process boils down to choose a «*satisfying solution*», the «sure gain» (**bounded rationality**).
    - Conversely a **broadened rationality** is involved within the negative frame because the outcome is morally unacceptable to wit **trade-off between uncertainty and outcome**. [▶ Flesh out](#)
- Specific activation of cognitive substrates involving S2 should be observed.

## Sketch of model to explain FE by introducing moral-emotional content (1 out of 2)

- «Broadened» rationality allows a difference of valence between the two equivalent – from a logical point of view – outcomes in FE.
- Use of a framework inspired of L L Lopes' theory of «security needs» and Prospect Theory's theory of status-quo.
- Define a «security seeker» as a subject who systematically outweighs the worst outcome in a gamble (sort of **max min behavior**) → The security seeker will choose the «*sure thing*» instead of the gamble in FE (to put it another way, she is risk averse).
- Hence if we just consider the «security needs» dimension (natural saliency of the worse outcome within a gamble), will predict risk-aversion behavior whatever the frame.

## Sketch of model to explain FE by introducing moral-emotional content (2 out of 2)

- Now let's consider the emotional-moral dimension.
- Claim: the «*sure thing*» in the negative frame of asian-disease is a morally unacceptable outcome. The representation of myself's causing human death has a **higher valence** (namely stronger negative psychological consequences) than the same logical output in the positive frame.
- Optimal choice for a «security seeker»:
  - If the «*sure outcome*» is acceptable then the trade-off process is simple: choice of the sure thing. → **Bounded rationality**.
  - Conversely if unacceptable the cognitive process goes beyond. → **Broadened rationality involves a cognitive conflict**.



# The retrieval test

- The experimenter explains the logical equivalence through a **purely descriptive speech**, namely she **does not** impose the rational norm:  
*«One might consider that the two problems are equivalent, to the extent that from a purely logical point of view, they are equivalent. Indeed, [here the analytical proof]...»*

◀ back

## Caveat related to the «*within-subjects*» strategy

- One session: 4 problems presented successively corresponding to the 4 scenarios (order is random), for the two frame: 8 choices per session.
- **Trade-off** regarding the choice of the experimental design: «*between-subjects*» design Vs «*within-subjects*» design.
- Relative **gain** of the «*within-subjects*» design: «framing effect» for individuals, not an aggregate outcome, and possibility to **exploit individual differences**.
- Relative **costs**:
  - Risk of bias, if the subject notices **the variation** in the frame (such variation if perceived is a **cue for the subject**, induced to be consistent in our experiment).
  - Risk of **memory** of the previous scenario while performing the next one.
- To solve this introduce «**filler**» tasks.

## These particular design is to reveal the «true» preference of the subjects

- We are aware of a **potential problem** associated with the «retrieval test»: if the subject was previously inconsistent in the FE experiment (namely provided a response in PF that is logically inconsistent with the one she gave in NF), might be inclined to provide **the same response pattern**; otherwise will suffer **psychological dissonance** → possible **Persistence bias**.
- We claim that **the first answer** (to the question: «*Would the average person judge that the two problems are equivalent?*») mirrors the «true» reaction of the subject (to wit the response without the dissonance effect); if **gap** between the first answer and the self-perspective → piece of evidence towards the existence of **psychological dissonance**.