The Role of Expertise in Risky Engineering Decisions

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OVERVIEW

- Engineering design decisions increasingly entail making risky decisions in complex situations.
- Here, we investigate the role of expertise in engineering problem solving.
- We aim to answer how engineering experts' risk judgments affect design decisions, disentangling two concepts, expertise and knowledge.

Research Questions:

- **How do NASA experts' perceive risk related to their design choices and make their design decisions accordingly?**
- **How do the risk perceptions of NASA experts differ from those of lay people?**

BACKGROUND

Fuzzy Trace Theory [1]

- According to Fuzzy Trace Theory, people rely on a continuum of mental representations, ranging from precise and **quantitative verbatim representations** of risk information to **qualitative, categorical gist representations** capturing the bottom line meaning of that information in context.
- The theory posits that individuals rely more on gist representations than verbatim representations – the so-called *fuzzy processing preference* [2,3].
- Expertise enables individuals to retrieve the proper gist; consequently, this preference is more prevalent among experts, as a result of their developmental advancements in subject matter. .

METHOD AND MATERIAL

Online survey was designed via Qualtrics

- **Decision problems.** Two binary risky choice problems involving design decisions for a hypothetical spacecraft [4]
- **Risk perception items:** Likert scale items measuring gist and verbatim representations about risk associated with spacecraft design [5,6].
- **Experimental design.** Lay sample was randomly assigned to three information transfer groups:
  - **(1) "Verbatim only" group.** Subjects received a short explanatory information, describing the risks of associated with design in detailed terms.
  - **(2) "Gist + Verbatim" group.** Subjects received the same detailed scenario, and also a short text communicating the following bottom-line meaning in categorical terms.
  - **(3) Control group.** Subjects received no explanatory text.

Sample: NASA + amazon mechanical turk

Sample size: 41 NASA employees

Sample size. 233 Mturk employees

This is the first instance of Fuzzy Trace Theory applied in a quantitative engineering context.

GIST OF RESULTS:

✓ Categorical and quantitative safety risk assessments are orthogonal.

✓ Categorical schedule and cost gists vary with expertise.

✓ Experimental knowledge treatment is associated with cost risk perception in the lay sample.

GIST OF THIS POSTER:

Gist matters.
NASA experts' gists drive their design decisions.

RESULTS

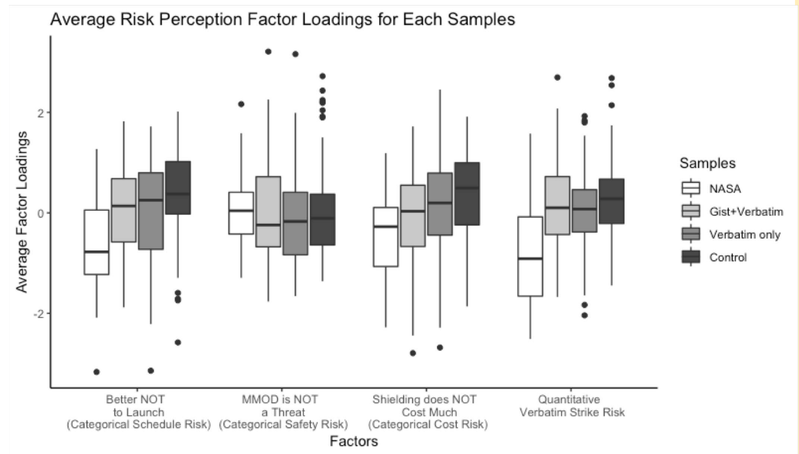

Figure 1. Risk perception differences among expert and experimental Lay sample groups

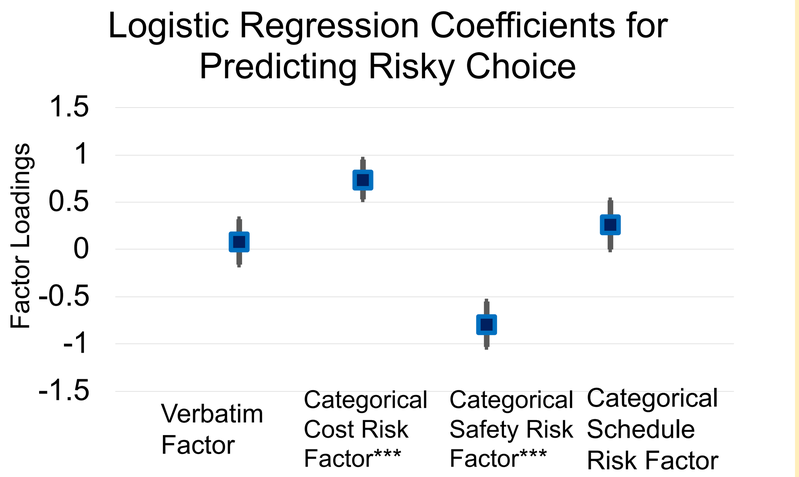

Figure 2. Association between risk perception factors and risky choices

DISCUSSION

- Our results support Fuzzy Trace Theory's predictions regarding distinct gist and verbatim representations in an engineering context.
- Furthermore, gist is more strongly associated with risky choice than is verbatim.
- Our results suggest that expertise is informed by feedback from the environment, and therefore insightful.

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