Towards a More Accurate Description of Human Decision Making: Satisficing Instead of Optimization

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1. Need for a more accurate description of human decision making

- To help people make decisions, we need to know how they make their decisions.
- Traditional decision theory assumes that for every two alternatives, a decision maker:
  - either prefers the first one,
  - or prefers the second one,
  - or decides that there two alternatives are of the exact same quality.
- Under this assumption, decisions of a rational decision maker can be described by assigning:
  - to each alternative A,
  - a numerical value $u(A)$ known as its *utility*.

2. Need for a more accurate description of human decision making (cont-d)

- For example, we can:
  - select a very bad option A_- and a very bad option A_+ and
  - define the utility $u(A)$ of an alternative A as the probability p for which A is equivalent to a lottery in which

$$\text{Prob}(A_+) = p \text{ and } \text{Prob}(A_-) = 1 - p.$$

- One can show that the utility of a decision in which we get different alternatives A_i with corresponding probabilities p_i is equal to

$$u(A) = \sum_i p_i \cdot u(A_i).$$

- Under this assumption, a decision maker always selects the *optimal* alternative.
- Namely, the decision maker always selects the alternative whose utility is the largest.

3. Need for a more accurate description of human decision making (cont-d)

- In practice, people usually do not exactly optimize.
- They select an alternative which is good enough.
- This is called *satisficing*.
- It is therefore desirable to take this into account when describing how people make decisions.

4. Proposed approach

- In practice, for some pairs of alternatives A and B, the decision maker definitely prefers A.
- We will denote it be $A \gg B$.
- For some other pairs, we have $B \gg A$.
- For the remaining pairs, the decision maker can select both A or B.
- We will denote this by $A \approx B$.
- It is important to mention that $\approx$ is not necessarily transitive:
  - if A is slightly better than B, we can have $A \approx B$;
  - similarly, if B is slightly better than C, we can have $B \approx C$;
  - however, the difference between A and C may already be significant, so we can have $A \gg B$.

5. Proposed approach (cont-d)

- Based on the relations $\gg$ and $\approx$, we can define an auxiliary relation

$$A \geq B \Leftrightarrow \forall C\,(B \gg C \Rightarrow A \gg C).$$

- For example:
  - if $A \gg B$ means $g(A) - g(B) \geq \varepsilon$ for some $\varepsilon > 0$, where $g(A)$ is monetary gain,
  - then the new relation is equivalent to $g(A) \geq g(B)$.
- For this new relation, it is reasonable to assume that we always have:
  - either $A > B$
  - or $B > A$
  - or A has the exact same quality as B.
- Thus, the new relation can be described by a utility function:

$$A > B \Leftrightarrow u(A) > u(B).$$

6. Proposed approach (cont-d)

- It is also reasonable to assume that if $A_1 \gg B_1$ and $A_2 \gg B_2$, then:
  - a lottery in which we get A_1 with probability p and A_2 with probability $1 - p$
  - is preferable to a lottery in which we get B_1 with probability p and B_2 with probability $1 - p$.
- It is also reasonable to require a similar condition for $\approx$.
- This implies that the plane of possible pairs $(u(A), u(B))$ is divided into three convex sets corresponding to $A \gg B$, $A \approx B$, and $B \gg A$.
- The border between two convex sets is a straight line segment.
- So we arrive at the following conclusion.

7. Conclusion

- We have $A \gg B \Leftrightarrow u(A) - u(B) > \varepsilon$ for some $\varepsilon > 0$.
- Here, $A \approx B$ means $|u(A) - u(B)| \leq \varepsilon$.
- This is the desired description of satisficing decision making.

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