On the Interpretation of Decision Problems with Imperfect Recall

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Abstract

In this paper it is argued that extensive decision problems (extensive games with a single player) with <u>imperfect</u> recall suffer from major ambiguities in the interpretation of information sets and strategies. This indeterminacy allows for different kinds of analysis. We address the following issues:

1. Randomization at information sets

2. Consistent beliefs

3. Time consistency of optimal plans

4. The multi-selves approach to decision making

We illustrate our discussion through an example that we call the absentminded driver paradox.

An individual is sitting late at night in a bar planning his midnight trip home. In order to get home he has to take the highway and get off at the second exit. Turning at the first exit leads into a disastrous area (payoff 0). Turning at the second exit yields the highest reward (payoff 4). If he continues beyond the second exit he will reach the end of the highway and find a hotel where he can spend the night (payoff 1). The driver is absentminded and is aware of this fact. When reaching an intersection he cannot tell whether it is the first or the second intersection and he cannot remember how many he has passed. While sitting at the bar, all he can do is to decide whether or not to exit at an intersection (we exclude at this stage the possibility that the decision maker can include random elements in his strategy).

Planning his trip at the bar, the decision maker must conclude that it is impossible for him to get home and he should not exit when he reaches an intersection. Thus, his optimal plan will lead him to spend the night at the hotel and yields a payoff of 1. Now, suppose that he reaches an intersection. Remembering his strategy he concludes that he is at the first intersection with probability 1/2. Then, reviewing his plan, he must conclude that it is optimal for him to leave the highway since it yields an expected payoff of 2. Thus, despite no new information and no change in his preferences, the decision maker is tempted to change his initial plan once he reaches an intersection!

We find this example paradoxical as it exhibits a conflict between two ways of reasoning. The first instructs the decision maker to follow his initial decision not to exit, as this is the optimal rule of behavior. The second leads him to optimize expected payoffs given his beliefs and to deviate from his initial decision.