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# Why Decision Paralysis

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**Abstract** If a person has a small number of good alternatives, this person can usually make a good decision, i.e., select one of the given alternatives. However, when we have a large number of good alternatives, people take much longer to make a decision – sometimes so long that, as a result, no decision is made. How can we explain this seemingly no-optimal behavior? In this paper, we show that this "decision paralysis" can be naturally explained by using the usual decision making ideas.

## 1 Formulation of the Problem

**Decision paralysis: a paradoxical human behavior.** If we have a few good alternatives, it is usually easy to select one of them. If we add more good alternatives, the decision situation becomes even more favorable, since some of these new alternatives may be better than the ones we had before. One would therefore expect that, in general, the more alternative, the better the person's decision will be.

However, in practice, often, the opposite happens:

- when a person faces a few good alternatives, this person usually makes a reasonable decision, while
- when the number of possible alternatives becomes large, a decision maker sometimes spends a lot of time deciding which alterantive to select and, as a result, does not select any of these good alternatives at all.

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This phenomenon is known as *decision paralysis*; see, e.g., [6, 12] and references therein.

**Example.** When a store carries one or two types of cereal, many customers buy cereal. However, when a supermarket carries dozens of different brands of cereal, a much larger proportion of customers end up not buying any cereal at all.

**How can we explain this non-optimal behavior?** From the person's viewpoint, not selecting any of the good alternatives is a worse outcome that selecting one of them. So why do people exhibit such an non-optimal behavior?

Usual explanations for this phenomenon are based on psychology – people are not very confident in their ability to make decisions, etc. However, while this explains *how* exactly people end up making non-optimal decisions, it does not explain *why* we humans – the product of billions of years of improving evolution – make such obviously non-optimal decisions.

**What we do in this paper.** In this paper, we try to explain the decision paralysis phenomenon from the viewpoint of decision making. We show that it is exactly the desire to make an optimal decision that leads to the decision paralysis phenomenon.

## 2 Our Explanation

**Rational decision making.** According to decision theory analysis, decisions by a rational person are equivalent to maximizing the value of a certain quantity known as *utility*; see, e.g., [4, 5, 7, 8, 9, 10, 11].

From this viewpoint, if we have $n$ alternatives $A_1, \ldots, A_n$, then a rational decision is to select the alternative for this the utility $u(A_i)$ is the largest.

**How can we make this rational decision: a general description.** A natural idea is to compute all $n$ utility values and to select the alternative $i$ for which the utility $u(A_i)$ is the largest.

**How can we make a decision: towards a more detailed description.** For each real number, an exact representation requires infinitely many digits. In real life, we can only generate finitely many digits, i.e., we can only compute this number with some accuracy.

Of course, the more accuracy we want, the longer it takes to compute the value with this accuracy. Thus, a natural idea is to compute only with the accuracy which is sufficient for our purpose. For example, if we select the world champion in sprint, then we sometimes need the accuracy of 0.01 seconds to decide on the winner, but if we want to decide whether a person has a fever or not, there is no need to measure this person's temperature with very high accuracy.

So, we compute all the utilities and find the ones whose utility is the largest.

We can only compute utility with some accuracy. The more accuracy we want, the longer it takes to compute with this accuracy.

**The more alternatives we have, the more time we need to make a decision: explanation of decision paralysis.** If we have only two alternatives, with utilities on some interval, e.g., $[0, 1]$, then on average, these two values are not very close, so a low accuracy is sufficient to decide which is larger. On the other hand, if the number $n$ of alternatives large, the average distance between theit utilities becomes much smaller: on average, this distance is equal to $1/(n + 1)$; see, e.g., [1, 2, 3].

Thus, the more alternatives we need to consider, the larger the accuracy with which we need to compute all the utilities to select the best one. Hence, the more time we need to compute all the utilities. This explains the observed decision paralysis phenomenon.

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