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Applied Decision Making With Fast-and-Frugal Heuristics☆

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In applied settings, such as aviation, medicine, and finance, individuals make decisions under various degrees of uncertainty, that is, when not all risks are known or can be calculated. In such situations, decisions can be made using fast-and-frugal heuristics. These are simple strategies that ignore part of the available information. In this article, we propose that the conceptual lens of fast-and-frugal heuristics is useful not only for describing but also for improving applied decision making. By exploiting features of the environment and capabilities of the decision makers, heuristics can be simple without trading off accuracy. Because decision aids based on heuristics build on how individuals make decisions, they can be adopted intuitively and used effectively. Beyond enabling accurate decisions, heuristics possess characteristics that facilitate their adaptation to varied settings. These characteristics include accessibility, speed, transparency, and cost effectiveness. Altogether, the article offers an overview of the literature on fast-and-frugal heuristics and their usefulness in diverse applied settings.

Keywords: Fast-and-frugal heuristics, Professional decision making, Applied decision making, Decision aids, Ecological rationality, Bounded rationality, Optimization

On January 15th, 2009, Chesley B. Sullenberger and Jeffrey Skiles, the pilots of US Airways Flight 1549, found themselves in a dramatic situation. Shortly after takeoff, a flock of geese hit the two turbofans of their Airbus A320, resulting in a complete engine failure. Within seconds, the pilots had to decide whether they would be able to return to LaGuardia Airport in New York or whether they would have to seek a more risky emergency landing spot. They decided against returning. Instead, Sullenberger conducted a spectacular landing in the Hudson River, saving the lives of all 155 passengers on board.

Sitting in the cockpit of a modern aircraft, you might feel overwhelmed by all the information on display. Avionics systems measure and monitor myriad pieces of information: from airspeed, altitude, heading, vertical speed, and yaw to navigational, weather, and engine indications. In modern airplanes, everything is connected to onboard computers, and there is

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plenty of computing power in the control towers that manage flight traffic. Given that these large amounts of information are available and ready to be processed by computers, decisions such as those made by the pilots of Flight 1579 might appear to be textbook examples of the successful use of optimization control techniques.

But when trying to find out whether they could make it back to LaGuardia Airport, Sullenberger and Skiles did not simply rely on their computers and flight instruments. As co-pilot Skiles later explained, "It's not so much a mathematical calculation as visual, in that when you are flying in an airplane, things that—a point that you can't reach will actually rise in your windshield. A point that you are going to overfly will descend in your windshield." (Charlie Rose, *The Charlie Rose Show*, February 11, 2009). What Skiles describes is a simple rule of thumb known as the *gaze heuristic* (Gigerenzer, 2014; Gigerenzer, Hertwig, & Pachur, 2011):

> Fix your gaze on a potential landing spot. If this spot rises in your windshield, then you will not be able to reach it.

This simple rule of thumb does not draw on the aforementioned information provided from the instrument panels. Instead, it considers the angle of gaze. The gaze heuristic has been reported to describe how dogs and humans, including professional baseball players, catch balls; sailors use a variant of this strategy as well. It belongs to a class of highly efficient decision strategies that have been dubbed *fast-and-frugal heuristics* (e.g., Gigerenzer, Todd, & The ABC Research Group, 1999).

The goal of this article is to make the case that the conceptual lens of fast-and-frugal heuristics is well suited to describing and improving applied decision making. We contend that the story of Flight 1549 is not an anomaly in this respect. In many naturally occurring situations, fast-and-frugal heuristics can aid decision making, and people (justifiably) rely on them. This conceptual lens can, we argue, more generally serve as a starting point for investigating and attempting to improve applied decision making in domains as wide-ranging as aviation, medicine, and business.

The structure of this article is as follows. We begin by providing a brief introduction to optimization and fast-and-frugal heuristics, two conceptual lenses often employed by researchers of applied decision making. Second, we discuss how fast-and-frugal heuristics can be simple and accurate at the same time. Third, we argue that because they are built on how individuals make decisions, fast-and-frugal heuristics can be useful in prescribing individual decision-making strategies. Fourth, we explore several characteristics that enable fast-and-frugal heuristics to be adapted to various situational requirements. These characteristics make fast-and-frugal heuristics particularly useful for improving applied decision making. In conclusion, we reflect on how this conceptual lens allows improving decision making even in situations when decision makers are better off to not rely on heuristics.

Conceptual Lenses for Describing and Improving Applied Decision Making

Instead of testing theories of decision making in experimental 'toy tasks' in which all options and probabilities are known for certain, researchers of applied decision making prioritize practical relevance. They seek to describe and improve decision making in real-life situations, in which appropriate courses of action often need to be determined under considerable uncertainty (e.g., Brown, 2015; Hoffrage & Marewski, 2015; Klein, 2015). In many cases, researchers of applied decision making might not deliberately select the conceptual lens through which they try to understand a specific problem. Yet the conceptual lens they inevitably employ directs their attention and determines which elements they address and which elements they exclude from their analysis. Conceptual lenses also establish a framework of assumptions needed in order to move from mere description of phenomena toward explanation, prediction, and prescription. Allison (1969, p. 690) uses the following metaphor: "Conceptual models both fix the mesh of the nets that the analyst drags through the material in order to explain a particular action or decision and direct him to cast his net in select ponds, at certain depths, in order to catch the fish he is after". We advocate that researchers actively select a useful conceptual lens. For researchers interested in applied decision making, conceptual lenses can be useful for (at least) two different purposes: first, to describe how people actually make decisions, and, second, to prescribe how people should make decisions under the constraints they face. Prescriptive measures include engineering decision aids and designing decision environments such that people can make good decisions.

Optimization

One family of conceptual lenses that many academics in business, economics, biology, and psychology rely on is called *optimization*. Optimization models represent the classical approach to human decision making and rationality, dating back to the Enlightenment and thinkers such as Blaise Pascal, Pierre Fermat, and Daniel and Nicholas Bernoulli. Prominent representatives of this approach are models of *Bayesian inference* and the *maximization of (subjective) expected utility* (e.g., Arrow, 1966; Edwards, 1954; Savage, 1954; von Neumann & Morgenstern, 1947; see also Becker, 1993; Chater & Oaksford, 2008, for more recent approaches). In the social sciences, these resulted in statistical tools such as linear models that estimate coefficients while minimizing errors. The resulting tools are not only widely used, but have also been transformed into theories of decision making (Gigerenzer, 1991).

By employing the conceptual lenses of optimization, researchers assume that they are in a world of *risk* (Knight, 1921). A world of risk is a world in which probabilities are known or can be reliably estimated; by definition, optimization is possible only in such worlds. Examples of worlds of risk with well-defined and predictable problems are lotteries, roulette, and card games. Savage (1954), the father of modern Bayesian Decision Theory, introduced the notion of *small worlds* to refer to such situations of perfect knowledge. They typically abound in economics and in business textbooks that instruct students how to use optimization methods.

In contrast to a world of risk, a world of *uncertainty* implies that the probabilities are unknown, unknowable, or not

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