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What do heuristics have to do with policymaking?

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Abstract
In an era where behavioral insights overwhelmingly shape policy interventions, heuristic-based decision-making merits closer consideration. That policy environments are complex is not a new topic, nor is the insight that simple heuristic solutions might work best in some complex situations. I move beyond the more common interpretations of heuristics, defined in terms of cognitive biases, to a research program focused on a systematic study of fast-and-frugal heuristics as effective decision tools. I suggest that this approach to heuristics provides a coherent framework for understanding why and how interventions based on behavioral insights work, which in turn can aid policymakers and their advisors on "What Works"**. I draw on nudge-based policies and Behavioral Insights Team report to illustrate my point.

**What Works is a network of centers that designs and implements interventions based on a mixture of tools for effective policy-making that includes bans, mandates, and incentives in addition to behavioral-based methods –headed since 2013 by David Halpern in the UK. I refer here to both this institution and the literal meaning of the phrase.

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> "The preternatural mind is becoming increasingly naturalized as we gain access inside our brains, psyche, and dare to admit the understandable simplicity of it all. Heuristics are tools to reach beyond the shelves of customarily understanding. Using them to make good and reduce bad in our world is our job".
>
> WARREN WEAVER, 1945

How do humans solve complex problems?

When Mackinnon and Wearing (1980) tasked their subjects with managing simulated welfare administrative projects, a surprising result surfaced. They developed a procedure to investigate human interaction with changing environments. These designed environments varied in complexity on three dimensions: number of factors (three vs. nine), interaction between factors (yes/no), and random variation (yes/no) –generating a total of eight (2^3) decision scenarios. The task was to allocate resources to three municipalities under different conditions of complexity, from the simplest scenario of three factors with no interaction and no variation to one with nine factors that interacted and had random variations. Performance was measured mainly by mean total welfare. Contrary to expectations, the authors found that the effectiveness of observed decisions did not decrease in proportion to an increased level of complexity of the assigned tasks. Instead, what appeared to have an overall positive correlation with task complexity was the increasing use of simple heuristics. That is, subjects did not match the complexity of task when choosing their strategies but instead often behaved to the contrary, by devising simpler strategies for more complex situations. This finding highlighted that there is little connection between heavily studied static decision-making situations –models of which are still used today for policy recommendations and designing regulations– and the actual complex context in which policymakers operate. An outline of the scientific status quo at the time (not radically changed to date) and main insights derived from this investigation are summarized in the authors' own words:

> Previous work in the areas of decision making and information processing taken with the available research and theory on the nature of the complex systems suggested that subjects' performances would be degraded when operating in more complex environments... The danger of extrapolating from simple situations (in this case the decision-making experiments that have been conducted by psychologists) to more complex ones is amply demonstrated. This should not suggest that psychologists have grossly underestimated the ability of decision makers to manipulate information. Rather, the complex situation may be different (i.e., require or allow a completely different approach) from the simple one. Individuals' widespread use of heuristics in many information manipulation situations is well known (see Newell and Simon, 1972; Slovic, 1972; Tversky and Kahneman, 1974). Heuristic methods which may be applicable to and success-

> ful in dynamic systems may not be applicable to the static decision-making tasks that have been widely studied. (Ibid., p. 294-5)

In other words, assessing the effectiveness of heuristic methods against a benchmark out of context leads to wrongly classifying heuristics as inferior. Also, assuming that people's use of simple heuristics in complex situations is associated with lower performance and thus in need of improvement through more complex solutions is not empirically supported. The reason is that norms and methods that model static situations are not simply extendable to dynamic real world situations (see Mousavi and Gigerenzer, 2010; who discuss this misassumption in the study of cognitive errors and call for developing content-sensitive norms). Mackinnon and Wearing conclude that "revision of theories of complexity within the social sciences may be necessary" (Ibid., p. 205). For the purpose of informing policymaking by insights from the study of human behavior, much of which relies on the use of heuristics, the message is as follows: Studying heuristics in a primary framework and assessing them on the basis of their observed performance is of central importance to an effective implementation of behavioral insights in designing policy interventions –an admittedly complex task that should be always performed in the context of a highly complex environment. Developing such frameworks is the bread and butter of the study of the ecological rationality of fast-and-frugal heuristics that we turn to next.

The study of fast-and-frugal heuristics

A systematic study of heuristics as effective decision mechanisms has shaped the research conducted at the Center for Adaptive Behavior and Cognition of the Max Planck Institute[1]. After two decades of research, this pursuit has spread to a variety of academic fields but remains largely in the shadow of mainstream interpretations of heuristic-based behaviors that are defined with respect to cognitive biases. Conceptualizing heuristics based on their useful properties and making sense of why heuristics are used and when they work well unravels processes underlying observed human problem-solving behavior and provides a systematic way of backward engineering rules, laws, and environments that trigger certain behavior. This endeavor starts with a conceptualization of heuristics that is based on their effectiveness.

What is an effective heuristic?

Heuristics are adaptive tools that ignore information to make fast and frugal decisions that are accurate and robust under conditions of uncertainty. A heuristic is considered ecologically rational when it functionally matches the structure of the environment (Neth and Gigerenzer, 2015; Mousavi and Gigerenzer, 2017). This definition contains several properties associated with effective heuristics as simple yet useful decision mechanisms, which we next examine in turn[2].

A heuristic refers to a decision mechanism that does not use all relevant or available information[3]. This property constitutes the frugality of heuristics. Furthermore, when faced with a problem or question, some solutions and responses often surface easily and quickly. If a solution is arrived at by drawing on such responses, then the choice mechanisms can be applied fast: hence the name fast-and-frugal heuristics. Whether a heuristic is effective can only be assessed with respect to the degree to which it matches the structure of a given problem, referred to as the decision-making environment. If the chosen heuristic solves the problem successfully, its choice is rational with respect to the environment in which it has been used. In this case, the heuristic is then referred to as being ecologically rational. Importantly, an absolute notion of rationality that stands independent of the decision-making context is simply irrelevant to the evaluation of heuristic effectiveness.

Fast-and-frugal heuristics are simple to use. They are simple not because they reduce the problem to a simple solvable form but because they can take account of evolutionary and otherwise learned or built-in capacities of human beings. An example is the gaze heuristic, which involves tracing a moving object against a noisy background. Fixing gaze on a moving object has evolved in humans and animals to enable them to intercept prey or to avoid the hunter. This ability manifests itself early on in infants as their eyes start following the baby mobiles hanging on top of their cribs. The same ability is exploited by a baseball catcher to intercept a flyball.

Consider, by contrast, the task of programming a robot to catch a ball. Achieving this goal is mechanically possible in two steps. First, the landing spot for the ball needs to be calculated, that is, the trajectory of the ball needs to be specified by the formula, for example, of a parabola with proper values for inputs such as wind and velocity. Second, the robot needs to be able to move to the calculated landing point and wait for the ball to arrive. This is an example of adopting a discrete structure for solving a problem. An attempt to view the same representation supplemented with evolutionary insights is made by Richard Dawkins (1976, p. 96) in *The Selfish Gene*[4]:

> When a man throws a ball high in the air and catches it again, he behaves as if he had solved a set of differential equations in predicting the trajectory of the ball. He may neither know or care what a differential equation is, but it does not affect his skill with the ball.

[1] mpib-berlin.mpg.de/en/research/concluded-areas/adaptive-behavior-and-cognition

[2] Hansjörg Neth suggested using the descriptors simple and effective for this approach to heuristics. (personal correspondence)

[3] In his definition of heuristics in 2013 at the Summer Institute on Bounded Rationality, Robin Hogarth put this property on top of the list. youtube.com/watch?v=nPXRKLndOfg.

[4] To better appreciate the distinction between the two descriptive accounts, recall the way you follow and catch a ball and think about which description captures your experience or your observation of such behavior.

When a man throws a ball high in the air and catches it again, he behaves as if he had solved a set of differential equations in predicting the trajectory of the ball. He may neither know or care what a differential equation is, but it does not affect his skill with the ball.

If this were true, we would expect catchers to run to a point that they have somehow calculated at a subconscious level and wait there to catch the ball. But that is not what they actually do. In fact, most judgmental tasks we perform daily do not follow such a discrete structure, but a continuous one (Hogarth, 1981). Continuous judgment produces a series of behavior without necessarily requiring the initial exact determination of the final point. Relatedly, Hogarth describes heuristics as "cognitive simplification mechanisms" (Ibid., p. 199). The key point in our baseball example is that the goal of catchers is not to calculate the landing point but instead to simply be there when the ball arrives. To that end, catchers follow a continuously implemented heuristic rule that guides their behavior as follows (see McBeath, Shaffer, and Kaiser, 1995; for a detailed discussion).

Gaze Heuristic: Spot the moving object, say a ball. The angle of gaze is the angle between the horizon and the initial line from the eye to the ball when it was first spotted. Retain this angle while moving with the ball. You and the ball will arrive at the same place. Catch it! (see Figure 1).

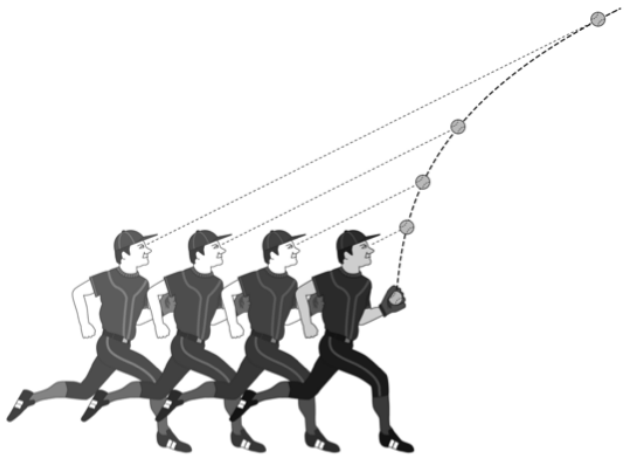

Figure 1. Baseball catcher uses gaze heuristic to catch a flyball.

The use of this evolutionary capacity of gazing as an effective heuristic for determining the interception point can be engineered in reverse and used deliberately. Hamlin (2017) provides a biography of this heuristic rule, recounting it to be the very reason that turned the developments of the Second World War in Britan's favor when implemented in fighters' strategy for attacking German bombers. Dogs catch a Frisbee using the same principle. In the taxonomy of heuristics, the gaze heuristic falls under the category of one good reason decision-making. Other categories include recognition-based decision-making, satisficing, and equal weighing (Gigerenzer and Selten, 2002; Gigerenzer and Gaissmaier, 2010; Mousavi, Gigerenzer, and Kheirandish, 2016). A systematic study of heuristics makes explicit the rules underlying effective heuristic-based behavior, such as the gaze heuristic, and thus provides tools for designing special-purpose environments.

A useful property of heuristic solutions is being robust to some changes in the environment. This simply follows from the trivial fact that if you have not considered something, you cannot be wrong about it. That is, when a factor is omitted any error associated with it seizes to exist. Because a heuristic ignores some information or factors, any changes in those ignored factors cannot change the chosen solution, meaning that it is robust. For the logically inclined reader, this matter can be considered akin to a conditional statement being true when the premise is false. In that case, the premise involves the very existence of a factor, reason, cue, or piece of information[5]. Yet another way to think about this, for empirical modelers, is to notice that when ignoring relevant information, you effectively drop the task of properly assessing that piece of information in terms of the solution to the problem at hand. In the case of linear representations, this means that you eliminate the variable and therefore are immune to making error about the associated correlation.

Heuristics constitute a considerable volume of behavior rules (for a comprehensive collection of works see Gigerenzer, Hertwig, and Pachur, 2011). Unraveling their structure and specifying the conditions of effectiveness has generated the scientific study of fast-and-frugal heuristics. Within this framework, behavioral insights can be systematically connected to policymaking and design of interventions. Examples in the next section illustrate this point.

Behavioral insights

In this section, I invoke some policy interventions used and understood as nudges or implementation of behavioral insights in policymaking and observe how these tools and approaches can be viewed from the lens of fast-and-frugal heuristics. Viewing them as such opens up a coherent and structured way for applying the findings from the study of heuristic effectiveness to the design of behaviorally informed interventions.

Lack of inclination for changing defaults is both fast and frugal. The physical property of inertia, that is, the strong tendency to remain in the existing state, is a fine descriptor for the lack of inclination to change the status quo –a prevalent behavior among humans and other species. Remaining with

[5] This refers to when "if P then Q" is logically true for all values of Q. Notice that here we are talking about relevant pieces of information. In the case of irrelevant information the conditional representation does not properly capture the consideration behavior. That is, when we do not find the premise, P, relevant to us, we ignore the entire statement. Consider this announcement: "If you are a teenager, you must walk on the right side…". Once you assess that the first component (the premise, P) is not relevant to you, your behavior consists of ignoring the entire conditional statement here. Most likely, you aren't concerned at all with the content or implication (or incompleteness, here) of the second part, Q.

the default can be viewed as a heuristic-based behavior in that it ignores information, especially the type of information that points to some contrary and invokes change. Thereby, the considered situation becomes simple and leads the agent to a fast response or lack of action. Thus, staying with the default constitutes a fast-and-frugal heuristic. In behavioral science, this tendency is commonly referred to as the status quo bias and is the most studied by far of all psychological inclinations on whose basis policy interventions can be designed and executed. The most famous case is probably that of organ donation, which shows a tremendous rate of acceptance when set as the default. In the absence of a strong incentive to actively opt out of a default, the default will be the modal status of affairs. Compared to rather expensive and lengthy campaigns for raising awareness, setting the defaults to the 'desired' outcome is a golden policymaking strategy. During his tenure (2009-2012) as the head of President Obama's White House office of information and regulatory affairs (OIRA), Cass Sunstein extensively utilized the design and modification of the default state of regulations as a powerful yet costless form of achieving socially preferred outcomes[6]. As a solid foundation for nudges, defaults are the hallmark of interventions by behavioral insight units. For example, pension reforms by Lord Adair Turner in England in 2010 enrolled, as a default state, all employees in automatic contributions to pension savings. Halpern (2015) reports that the rate of opt-out remains under 10%, and the increase in pension savings is considerable.

Behavioral insights go beyond nudges. In his 2015 book Inside the Nudge Unit: How small changes can make a big difference[7], the first head of the Behavioral Insight Team in the UK, David Halpern remarks,

> A 'nudge' is a subset of a wider, more empirical and behaviorally focused approach to policymaking.
>
> Consider how a law actually works. A parliament or executive passes a resolution that says that henceforth there will be a new requirement on people or businesses to do something in a particular way (or not to do something). The lawmaker normally attaches a sanction or penalty to those who fail to comply, such as a fine or imprisonment. But the link between the passing of the law and actual behavior is very distant. It is premised on an arguably naïve model of human behaviour. It assumes that somehow people will have heard about the new law, and realized that it applies to them. It assumes that they will weigh up the costs of breaking the new law, with the risk of being caught, and conclude that they should comply. And it assumes that in the moment and context of temptation, all of this will come to mind, and that these considerations will outweigh other pressures and temptations.
>
> It's a heroic series of assumptions… When things don't work quite as you expect, and it keeps happening, it's time to reappraise the way you think about the world. (p. 25-6. Kindle location: 401)

Expecting laws and policies to be effective as long as cost-benefit calculation reinforces them is not supported by evidence. Behavioral insights can provide alternatives, which do not necessarily refute the existing methods but revise them in constructive ways informed by knowledge about human behavior.

Habits can be understood as heuristics. Traditional law and economics emphasizes incentives, commonly referred to as the carrot-and-stick approach, which, analyzed in static models of action, implies that a particular behavior can be initiated, promoted, or eliminated if the proper reward or punishment is installed. Psychologists take a rather procedural view of this matter, as Halpern (Ibid., Kindle location: 353) elaborates: "The 'rules' and cues of the road have evolved over more than a hundred years, with a range of approaches emerging to keep us safe from ourselves and each other –and nearly all resting on the creation of new 'habits' and the prompting of each other to keep them". Along the path of turning traffic cues into habits, imposing fines plays a reinforcing role. Once the habits fall in place and become part of accepted social norms, people frequently become active reinforcers of the rule. Consider the heuristics in our adaptive minds simply as habits that have evolved over many generations or learned in particular situations by individuals. Thus viewed, it is clear that a scientific study of heuristic mechanisms reveals much knowledge on the structure and formation of habits, which in turn can be used to design environments and nudges that elicit a certain behavior or shape a desirable habit. Interestingly, the path from attitudes to behavior is a two-way road, as revealed first in the studies of cognitive dissonance (see, for example, Festinger, 1957; Festinger and Carlsmith, 1959). If so, the findings from the study of heuristic mechanisms can also help in discovering the roots of existing behavior and thereby reveal paths to prompt new behaviors. Psychological studies have a wealth of knowledge to offer to policymakers beyond the traditional psychological operations that have been used mainly for treating damaged agents after war or other intrusive missions.

Three strands of psychology and popularization[8] *of them set the ground for implementable behavioral insight*. One is experimental psychology, or the study of perception and interpretation. We shape perceptions based on experience

[6] In 2012, the New York Times reported, "Mr. Sunstein emphasizes the economic benefits of the regulations he has vetted, saying the net benefits have exceeded $91 billion, a figure he says far surpasses the benefits of rules issued by previous administrations". nyti.ms/QAx9jZ accessed on February 21, 2018.

[7] This section draws heavily on this book.

[8] One of the famous general books that first brought psychological findings to the public attention was Robert Cialdini's *Psychology of Persuasion* in 1984.

and interpret our surroundings accordingly by selective attention and ignorance. We note changes while tending to ignore constants and perceive relevance on a subjective basis. These findings have long been used in marketing and only rather recently, in a systematic manner, in policymaking. The second strand is cognitive psychology, which views humans' cognitive abilities as a scarce resource required for judgment and decision-making and explores the rules for allocating this resource when faced with a large variety of tasks. A main finding related to the use of behavioral insights in policymaking is the existence of systematic inclinations and certain predispositions that allow for both predicting behavior and eliciting certain behaviors. Social psychology is the third strand, which has revealed underlying processes associated with puzzling behavior such as submission to authority in spite of moral deterrents and subjects' strong desire for conformity in laboratory experiments. Two of the most famous studies are Asch (1951), who demonstrated how social pressure induces conformity to accepting (on the whole obviously) wrong judgments, and Milgram (1963), who showed that obedience toward superiors is the main driver in atrocious acts of war and torture. These studies showed that "extreme human behavior is not an aberration, but something that most people would exhibit if the context prompted them" (Halpern, 2015; Kindle location: 445). This and other profound insights into human psyche were more often than not contrary to inferences generated from deductive thinking. Laboratory examinations, usually as randomized controlled trials (RCTs), are currently the very first step taken in projects implementing behavioral insights. Beside RCTs there exist a depository of "behavioral insight tools", including MINDSPACE, a checklist for assessing effectiveness of policies, and EAST, a guideline for behaviorally informed methods of implementation of policies, at ministries' disposal to reevaluate and enhance policies already in place in an economical manner.

The success of behavioral insight projects is reshaping policymaking. The traditional policymaker follows and reinforces a mixture of elitism and charisma, crystalized in the adage "Better decisive and wrong than indecisive". Two main achievements of the Behavioral Insight Team are (1) the development of a new norm for ministers and other politicians to feel comfortable saying, "I do not know!" and (2) instead of committing to one best way of delivery to test several possible ways and find the best solution –or sometimes several case-dependent best solutions– to emerge before implementing a policy at the national level. This shift in conduct has resulted in a significant reduction of expenses resulting from the previous decisive but less behaviorally informed policies. All in all, an astonishing phenomenon is reshaping or amending traditional ways of policymaking, what Halpern (2015) refers to as "the rise of experimental government" that remedies "the old and dirty secret of much government policy, and professional practice, [which] is that we don't really know if it is effective at all".

Summary

Policymaking is a complex task, usually too complex. What motivated many scholars in different disciplines for the past few decades is a fascination with the fact that people deal amazingly well with very complex situations by using simple rules. This paper started with revisiting a pioneering study by Mackinnon and Wearing (1980), who observed: "people seemingly do make effective decisions in complex environments, the [literature surveyed] above suggests that we have much to learn about how individuals comprehend, form hypothesis about, and make decisions in many real-world situations. If one were to simply extrapolate the predictions made in related areas such a decision making, one might hypothesize that such tasks are beyond human ability" (p. 287). The takeaway is to turn the focus from cognitive limitations and what they prevent humans from achieving to humans' demonstrated abilities. The study of fast-and-frugal studies and their ecological rationality has evolved exactly around this focus. In this approach, effective heuristics are an enhancing addendum to the norm-generating set of mathematical and logical tools for making good decisions. Moreover, because of their roots in human behavior, heuristic studies provide a platform for systematic exploration of what works where and why. In sum, the systematic study of success criteria for simple heuristics is a promising platform for generating behavioral insights.

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