In preparation for: *The American Journal of Psychology*

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Gigerenzer, Basic and Applied

Review of 'Simply rational:

Decision making in the real world.'

by Gerd Gigerenzer

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"First instinct – Bam! Answer!" ~ Billy B., gas station attendant and savant, East Greenwich, Rhode Island, when asked how he makes decisions

Gerd Gigerenzer needs no introduction. So here's an introduction: As Director of the *Center for Adaptive Cognition and Behavior* at the *Max Planck Institute for Human Development* in Berlin, Gigerenzer has forged a broad, deep, and distinctive research program on judgment and decision-making (JDM). The program is broad because it touches many aspects of theoretical and applied questions in JDM. Theoretical questions include 'How do humans reason under uncertainty?' 'What cognitive tools do they use under what circumstances?' 'How does the task environment interact with basic psychological capacities with which humans are endowed?' Practical questions include 'How can decision-relevant information be presented or displayed so that humans, given their capacities and cognitive tools, can make judgments and decisions that advance their own interests and the interests of the groups in which they live?' 'How can we better understand the forces that throw up barriers to making progress towards JDM in the service of personal responsibility?' The research program is deep because it articulates building blocks of JDM, both at the individual psychological level and at the environmental or task level. The overarching framework (to which interestingly Gigerenzer rarely refers as a theory) integrates these building blocks and thereby yields an 'ecological' plane of analysis that transcends the merely psychological and the merely situational. Finally, the program is unique because there is nothing quite like it in the fuzzlily bounded domain of JDM.

Gigerenzer and his team have edited and published several volumes describing progress in the ecological paradigm, and Gigerenzer has written several books targeted at various audiences. The third type of book coming out of Berlin is a collection of previously published papers. By my count, the present volume, *Simply Rational*, is the third of this type. Its mission is to forcefully advance the claim that rationality can be attained – in its proper ecological context.

Three are three lines of advance, each anchored by one ambitious, long, and high profile paper, and supported by smaller specialty papers. The first line is to show how, with the use of natural frequency displays, consumers of healthcare and the people who treat them can easily, reliably, and validly assess the risks of different types of treatment and no-treatment. The indictment is that the medical culture still irrationally relies on conditional probabilities, single-event probabilities and other indices that are either difficult to comprehend, outright misleading, or both. The second line is to show that most of human reasoning (and some reasoning among our nonhuman relatives) proceeds with the use of heuristics. The key insight here is that most JDM problems that the real world presents to us come with irreducible uncertainty, which makes the use of conventional algorithms impossible. The indictment here is that conventional JDM still adheres to the Bayesian or expected utility probability calculus, which are well suited to solve fully defined problems, as, for example, in risk analysis, but of uncertain value in contexts of uncertainty. The third line is to show how behavioral economics has betrayed both conventional economics and psychology. Behavioral economists have freely borrowed – often without attribution – from psychological theory and research, and they have claimed to surpass conventional, pre-behavioral economics. The indictment is that behavioral economics is not a revolutionary but a reactionary movement. It reinforces fossilized traditions in economic thinking and infantilizes the decision-maker in the street and in the lab.

The papers making these three lines of advance are bookended by two personal notes. In the introduction, Gigerenzer announces the general principle guiding his research: "Behavior is a function of mind *and* environment" (p. vii, italics his). This is pure Lewin, and it would have been nice to see the legacy of the great social psychologist acknowledged. Gigerenzer is a master of the history of ideas in science and in psychology in particular. How did he miss this one? True

to his penchant for history, Gigerenzer begins with a personal tale, which turns out to be highly significant. As a student, he sat in a statistics class where the instructor did little beyond writing formulas on the blackboard. Later, he (Gigerenzer) came into contact with statisticians who openly discussed the origins of their theories and assumptions and how they differed. This was a decisive moment because it revealed that there are several schools of statistics, each an exercise in applied mathematics built on partly arbitrary assumptions, preferences, and worldviews. The end consumer, whose welfare depends on statistical information, is unaware of this underlying diversity and arbitrariness. The consumer needs to learn to think with statistics and about statistics. I had a similar experience when I was a student at the University of Bielefeld, a town that according to Gigerenzer promotes academic excellence because it offers few distractions. Our instructor, Dr. Matthias Geyer, told us at the end of the semester that his goal was not to have us know all the statistical formulas, but to enable us to think statistically. My response was "Now you're telling us!" Gigerenzer shares Geyer's goal and he shows his readers how it is done.

In his concluding paper, Gigerenzer reflects on the status of theory in psychology and JDM. He diagnoses the use of one-word re-descriptions as a shoddy way of theorizing. Mere labels are theoretical impostors; they court circularity, tautology, and reification, all of which can be regarded as fallacious even by the lights of conventional rationality. A more intriguing idea is the theme of "tools-to-theories." Many psychologists are more comfortable with (and better trained in) refining existing methods and inventing new ones than with theorizing. Their methods then constrain what kinds of questions they can ask and how they may conceptualize the material under study. Here, what psychologists think of as their theories are in fact artifacts of their methodological pre-commitments. For most psychologists, this move from tool to theory is an

implicit process, which they then falsely reconstruct as running in the opposite direction. Some psychologists, however, are fully aware of this process and endorse it with enthusiasm (Greenwald, 2012). Gigerenzer holds to the traditional standard, which demands that theory come first, be articulated explicitly, and then inform the selection of tools for study.

So much for the general idea. In the second half of this review, I will introduce Gigerenzer's three lines of argument by focusing on the three main papers.

The sickness of conditional probabilities

Chapter 5, previously published in *Psychological Science in the Public Interest*, shows what is wrong with the standard presentation of health statistics and what can be done about it. There are two great stories in this chapter. The first story is that the use of natural frequencies can solve many statistical headaches. What patients and physicians need to know are the probabilities that a disease is present or absent given a positive or negative test result. When the test result is positive, this conditional probability is 'Positive Predictive Value' (PPV) Typically, the PPV is computed as the product of the test's sensitivity (i.e., the probability of a positive result given that the disease is present) and the overall probability of a the disease in the population divided by the overall probability of having a positive test result. This is difficult to compute and even trained professional tend to confuse the PPV with the test's sensitivity.

Natural frequencies greatly simplify matters. Once we realize that the crossing of two dichotomous variables yields a 2 x 2 table with four joint frequencies, any marginal probability is obtained by simply adding to of these four, and any conditional probability is obtained by dividing one of the four joint probabilities by one of the marginals. The test result is either positive or not (first dichotomy) and the disease is either present or not (second dichotomy). Therefore, the PPV can be computed by dividing the number of people, say out of 10,000, who

have the disease and a positive test result by the number of people who have a positive test

result.

"Bam," as Billy B. would say, "Answer!" But this is an answer that does not present

itself with out training (which Gigerenzer provides). I once tested negative on a test for the gene

associated with Tay-Sachs syndrome. When asked what my probability of having the gene was

given the negative test result, the lab professional stubbornly repeated that the test catches most

cases that have the gene (Franklin & Krueger, 2003). I could have asked her to produce the four

joint frequencies, but I doubt she had them. Alternatively, if the test's sensitivity, its false-alarm

rate, and the disease base rate are known, the natural frequencies can be reconstructed, and a

rational estimate can be made, but that would be to put the cart both before and behind the horse.

When we can go from frequencies to Bayesian probabilities and back to frequencies, frugality

forces us to bail on Bayes.

Other concerns have to do with a family of statistics (e.g., survival ratios) that obscure

what really matters (i.e., mortality rates). A host of problems are associated with these bad

statistics, chief among them overtreatment, financial loss, and unnecessary pain. Gigerenzer

comes up against the question of why society remains saddled with this type of bad practice.

Surely, the vaunted irrationalities of the human mind (vaunted by conventional JDM, not

Gigerenzer) cannot be the culprit. Financial interests play a role, since the scanning, testing, and

treatment industries are of mammoth proportion and influence. Gigerenzer treads carefully here,

and one wishes that his work will be picked up by sociologists of medicine and public health.

Thinking on the cheap

Chapter 7, previously published in the *Annual Review of Psychology*, lays out the

paradigm of ecological rationality, showing how a suite of fast and frugal heuristics succeed in

producing good judgments and decisions, and how they can even beat presumably optimal rules. Doing so, this paradigm shifts attention from the study of people and their shortcomings to the study of psychological processes and their properties. Two interrelated stories run through this chapter. One is the tale of 'less being more' and the other is that use of more begets an overfitting of past data with a loss of future predictability. The less-is-more narrative is critical to Gigerenzer's research project. It is as important as it is surprising. How can less information lead to better judgment? By the lights of conventional theory, this is impossible. As Gigerenzer notes, adding valid predictors necessarily increases the squared multiple correlations, that is, the total explained variance. Heuristics, by definition, discard some information, which is what makes them frugal. In the game of postdicting the past, they cannot win. But no one should care about the past because the scientific success depends on predicting the future, or what Gigerenzer calls out-of-sample prediction. Efforts that focus on fitting existing data while ignoring the need to predict the contents of yet unseen samples fail a basic test of rationality (Dawes, 1988; Krueger, 2000).

In predicting the yet-unrevealed, many heuristics using few cues and making only modest demands on psychological capacities can excel. The recognition heuristic (see also chapter 8) is frugality *par excellence*. This heuristic capitalizes on a foundational psychological process, namely the capacity to match a new pattern to an old one in order to determine identity. This heuristic works well when there is variation in recognizability over items within a set and when there is covariation with to-be-predicted variables, such as size or fame. Even when all items are recognized, the experience of ease of recognition (i.e., fluency) can step in as a secondary heuristic.

Yet, not everything is perfectly settled. Consider two lingering issues. First, how should one think of Tversky and Kahneman's (1974) trinity of the representativeness, availability, and anchoring heuristics? Gigerenzer dismisses them as exercises in mere labeling, in which case they are not heuristics at all by his definition. Alternatively, these heuristics might be reconstructed as processes with search, stopping, and decision rules, much like recognition or fluency, *inter alii*. Like the recognition heuristic, representativeness capitalizes on the capacity for pattern matching, and anchoring might be seen as one-cue heuristic. Second, there remain large swaths of territory where one-cue heuristics do terrible damage. Gigerenzer briefly notes the sway sacred values hold over many people's (including politicians') imagination and decision-making. Being lexicographic and noncompensatory, they trump all other considerations, sometimes with the decision-maker being fully aware of how absurd it is. In a debate among Republican hopefuls (February 25, 2016), Donald Trump vowed to defund Planned Parenthood while pointing out the great value this organization has for public health. A single Judeo-Christian value nullified a mountain of social good and human benefit. In short, the heuristic paradigm might benefit from a set of meta-rules that help people see when to pull back from the too-fast and too-frugal. Billy the epigraphic gasman cannot get all the answers by relying on first instincts.

Economics is even more dismal than you thought

In chapter 11, Gigerenzer declares the bankruptcy of behavioral economics. His critical analysis is timely because behavioral economics has cast itself as the decisive alternative to economics-as-usual. The behavioral economists' claim is two-fold: test economic predictions with empirical data and revise economic theory in light of the findings. The first claim is well taken. For too long, economic theory has been content in the comfortable confines of

mathematical coherence, and real people be damned. The critical question is rather how empirical tests are designed, how (or whether) these tests are informed by non-circular psychological theory, and whether indeed the findings lead to the refinement or replacement of theory.

With regard to these questions, Gigerenzer shows that the field of behavioral economics is barren. He resumes the theme of overfitting by showing that three prominent behavioral theories add parameters to standard utility theories to improve fit. But fit is not explanation; it is mere labeling. Paradoxically, the fitting paradigm reintroduces the problem it should overcome. It assumes that people make optimal decisions, but now that more considerations (parameters) are in play, their task has become far more difficult. The result is a paradox: the ordinary decision maker is not smart enough to think rationally by the lights of neoclassical economics, but smart enough to solve even more complex optimization problems. Not only Aristotle would object to the idea that a person is at the same time smarter and dumber than some standard. By this most basic criterion of rationality (i.e., freedom from contradiction) behavioral economics fails.

Behavioral economics tries to dodge this problem by ignoring it. There are few explicit claims about what people do and many vague references to psychology. Without clear commitments to testable processes, behavioral economics – much like neoclassical economics – lingers on the low rung of an as-if theory: 'The data are compatible with the view that people solve differential equations, but we don't really know, or care.' Gigerenzer, again writing with the authority of someone who has looked deeply into the history of science, points out that scientific progress moves from as-if models to explicit models. Unless we reject this maxim, we must conclude that much of behavioral economics as seen today is regressive.

There are two further problems. First, there is little evidence for the claim that the failure to satisfy strict criteria of rationality results in material losses or a reduction in the quality of life. This is an empirical null result of great importance. Typically, it is assumed that violations of coherence rationality (e.g., freedom from contradiction) will necessarily lead to exploitation at the hands of nature or mean people. A set of intransitive preferences, for example, can be used to design a money pump that will bleed its irrational victim dry. Apparently, however, that which can happen is not bound to happen. If it did, none of the frugal heuristics reviewed in chapter 5 could ever top an 'optimal' model. Second, there is 'libertarian paternalism,' which in my reading Gigerenzer condemns as hypocritical and exploitative, although he does not use such harsh words. Libertarian paternalism is after all paternalistic, and a person cannot be fully free to decide when an authority, however benign, has constructed the decision space in such a way that a particular outcome is all but a foregone conclusion. A population governed by paternalistic rules is more pathetic than a population of slaves. The slaves know that they are not free.

JDM for the free

Gigerenzer's contempt for libertarian paternalism is emblematic of the spirit of his entire research program. His goal is to advance science by applying the highest theoretical and methodological standards. This requires the study of reasoning processes in their natural ecology. Both humans and environments are malleable. Humans can learn – and they do so best when their basic capacities are being engaged; environments can be designed – not paternalistically, but realistically. Gigerenzer practices what he preaches. His decades-long investment in the training of medical, judicial, and educational professionals reveals that his bottom line of concern is human freedom and well-being. Again, there is an unacknowledged bit of Lewinian

legacy. There's nothing more practical and useful as a good theory. And isn't that the point of being 'simply rational?'

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