



SOCIETY OF ACTUARIES

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# THE EVOLUTION

# OF THINKING

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“At first glance,  
**Homo sapiens** is an  
unlikely contestant  
for taking  
over the world.”

— Gerd Gigerenzer

**E** VOLUTIONARY BIOLOGISTS have identified that one of Homo sapiens’ original competitive strengths was the ability to run for very long periods of time, chasing their prey to exhaustion. For my money, in the primitive world, I would have chosen large teeth and blinding speed any day.



### HEURISTICS

As we know, that did not mark mankind’s only advantage, as we eventually figured out how we could use tools. And best of all, man was one of the best on the planet (among larger life forms at least) in adaptation. Gigerenzer calls this competitive advantage the “fast and frugal heuristic.”<sup>1</sup> With this approach, humans developed ways to best use both man’s limited natural and constantly growing artificial toolset regularly adapting it to the environment. A fast and frugal heuristic approach is a way to solve problems quickly with incomplete information.

Gigerenzer gives an example of a heuristic used by a baseball outfielder in catching a fly ball. In most cases the outfielder will catch the ball on the run; a natural heuristic is to keep moving and making small adjustments to their position until they and the ball are in the same location. Binocular vision does not necessarily provide enough information soon enough to position the outfielder properly in a timely basis. Observations obtained by successfully closer approximations act as using a much wider set of eyes. The heuristic uses a skill that the human brain already has—the ability to process multiple images of the same object to develop a three-dimensional view of the world.

The scientist might suggest that somewhere inside the brain there is an immensely complicated calculation of forces, directions and wind speeds going on. Gigerenzer suggests that is

nonsense. People do not even need to think that way.

Flash forward 10,000 years from the early primitive heuristic users. Zoom to the world of insurance and pensions and a conflict arises for the key decision maker. On the one hand is management or the underwriter whose decision-making process is the product of thousands of years of advances in the “fast and frugal heuristic” who is now regarding the financial risks that insurers and pension plans have been applying more or less profitably for a few hundred years. Their ability to make judgments in this are-

Constant tension between actuarial model builders and heuristic wielders exists when the major decisions of the firm are being made. Since actuaries do not always win, we sometimes feel ignored and underappreciated. In fact, jokes are made about the actuarial approach by the followers of the heuristic approach.

But the two approaches are closer than one might think at first (or even repeated) exposure to the issue. Both approaches have at their core a Bayesian view of how to derive the right decision, which is constantly updating your decision-making engine with new experiences.

the use of regular observation. Only a few hundred years have gone into perfecting this approach, not the thousands of years that support heuristic processes.

“In judgments under uncertainty, one has to ignore information in order to make good predictions.”<sup>2</sup>

Gigerenzer also shows how simple heuristics can outperform complex models. He suggests that models fit to historical data and predictive quality might well have an inverse relationship. The awareness of this is something that actuaries develop through experience.



## YOU MIGHT BE SURPRISED TO LEARN THAT ACTUARIAL METHODS HAVE BEEN IN THE MIDDLE OF A HEATED DEBATE ON THIS TOPIC FOR MORE THAN 60 YEARS.

### ACTUARIAL VERSUS CLINICAL DECISION MAKING

na is usually honed by decades of experience, avoiding the necessity to run down their prey for days until it dies of exhaustion. Some of these heuristics can be readily explained to colleagues in the business decision-making process, but some cannot be put into words any better than a baseball player can explain exactly how they are able to hit a 95-mile-per-hour fastball. Those heuristics are called “gut instinct.”

On the other side of this debate are the actuaries. Actuaries represent one of the most highly evolved practitioners of the scientific/statistical/evidence-based approach. We are trained to build what can be excruciatingly complex models of small bits of the world to use as the basis for our decisions. These actuarial models rely upon a number of statistical laws for their power, such as the law of large numbers and Bayes’ theorem, the use of credibility theory.

The heuristic decision makers may cast a wider net for information to bring into their heuristic. The modelers are usually limited to specifically quantifiable information that can be put into their models. Since the heuristic group does not have a quantitative model, they do not have that constraint. However, their disadvantage is that they do not necessarily include a systematic way to incorporate new information. The heuristic forming process is not necessarily a fully conscious process. In fact, explanations of heuristics are usually post hoc, not really a part of the development process.

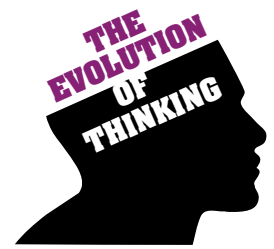
This flaw does not make heuristics anything to sneer at. Humans took over the world primarily because of this ability to create and update powerful heuristics.

The actuarial, statistical approach is a development of the scientific revolution, through

You might be surprised to learn that actuarial methods have been in the middle of a heated debate on this topic for more than 60 years. Certainly few of us actuaries even know about this debate. Clinical psychologists have had a running debate about whether actuarial or clinical predictions are better. Paul Meehl first raised the issue in 1954,<sup>3</sup> with the debate continuing into at least the 1990s.

In a 1989 article titled “Clinical versus Actuarial Judgment” in *Science*, Robyn Dawes and David Faust claim that clinical judgments are made in the heads of clinicians while actuarial judgments rely solely upon established relationships between data and outcomes.

This appears to be a clash between models and experts relying on their judgment, the very conflict that many have said was at the root of the global financial crisis of 2008. Meehl indicates that he became interested in this issue while attending a meeting in 1947



where the issue was hotly debated. Meehl's primary contribution was the suggestion that there should be an experimental way to show the difference in efficacy between the two methods. He suggested that anecdotal evidence that was prominently relied upon in the 1947 debate was never going to lead to a resolution of the question.

"It has been generally accepted in psychology that certain types of risk assessment (violence, sexual recidivism, domestic assault) are more accurate when an actuarial approach is used. These days very few clinicians would go into court using only a clinical opinion. When the court asks what is the likelihood of future violence, for instance, most will turn to actuarial risk assessment. My own area of expertise is the assessment for the risk of sexual violence, and I testify a lot about how these tools work (and don't work)."<sup>4</sup>

Meehl suggested that what was needed to resolve the issue was a large number of comparable or preferably identical situations where the information was available for both the clinical and statistical approach and that the actual correct diagnosis was known from information obtained subsequent to the initial diagnosis. This was accomplished. Meehl documents several such studies. And in every single study, the statistical approach was more accurate than the clinicians. In fact, the actuarial approach was as good as the best of the clinicians in diagnosis.

So, while this particular debate seems to have been won by the statisticians, it is still interesting to assess the issues raised along the way.

Meehl kept revising and republishing his 1954 book. The latest edition was published in 1996. In that version he suggested that the

clinicians might agree with the actuarial approach if they slowed down and understood it. He then showed that both clinicians and actuaries started from and processed the data in a similar manner. However, it was rare that clinicians revised the diagnostic methods they were taught in the university and during internships. Their methods were frozen and did not allow for new data to influence their approach, at least not until there was an overwhelming amount of contradictory data.

In contrast, statisticians update their assumptions when they obtain new data.



### ACTUARIAL PLACE IN THE EVOLUTION OF THINKING

Crudely, you can characterize these three ways of thinking along a historical spectrum. Heuristics are the best of primitive man. The shaman was the master heuristic wielder. Clinical or expert judgment was the path of the middle ages. Everyone studied the ancient masters. The most important thing to know to answer any important question was,

"What did Aristotle say about that?" And the statistical approach is the basis of the scientific revolution. Everything was reasoning- and evidence-based.

Real actuaries, not the actuaries of the psychologists' discussions, place our practice somewhere in the middle of these methods.

First of all, actuaries generally use both statistical and clinical decision making; or more accurately, a blend of the two.

Jim Bridgeman, FSA, CERA, MAAA, describes it in the following way:

"In a long actuarial career I have always found (following the lead of actuarial mentors with long careers and mentors in back of them) that the most effective and most characteristically 'actuarial' way of thinking involves a subtle melding of clinical (in insurance read 'underwriting, claims and marketing'), statistical, financial, and dynamic modeling ways of thinking.

"The role of the actuary is to bring in all possible sources of information, all pos-

## EXTRA INFO

### FOR MORE INFORMATION ON THIS TOPIC, VISIT THE WEBSITES LISTED BELOW.

The SOA's Competency Framework tool allows members to assess their business skills. Visit [www.soa.org/competency-framework](http://www.soa.org/competency-framework)

This professional development e-course focuses on decision making and communication. Visit [www.soa.org/decision-making](http://www.soa.org/decision-making) 

sible clues, all relevant ways of thinking and all applicable procedures for decision-making that can possibly be brought to bear on the decision to be made.

“In this view, the only reason actuaries generally come from a mathematical background is that generally only someone with a mathematical background (including in that, possibly, statistics, engineering, physics, etc.) is capable of even thinking about bringing in the dynamic modeling ways of thinking, subtle quantitative clues (those numbers just don’t smell right) and the most sophisticated aspects of the statistical way of thinking. Few others even know those ways exist, what they might mean, or how to handle them.

“But it is a poor actuary, indeed, who thinks that her role is to bring in only statistical thinking and/or dynamic modeling thinking and/or structured analytic processes. The actuary’s job is to integrate it all—the precise, the anecdotal, the experiential, the judgmental. It’s just that in most cases the mathematical aspects won’t even be there to get integrated unless the actuary brings those parts in herself. But she can’t stop with just those aspects if she’s going to uphold the tradition of the best of the profession.”<sup>5</sup>

Actuaries, with their blended approach, end up including some of both approaches, along with the strengths and weaknesses of both approaches. While actuaries do spend a great deal of time updating data, we are much more reluctant to change the model that data seems to fit.

The flaw to the statistical approach is that it includes an insatiable need for data. The practitioner of the statistical method will always want more and better data.

And that is where the heuristics come to play. In mathematical terms, heuristics are decision-making rules that work from principal components analysis. The best heuristic will use the readily available data that is the most highly correlated with the best outcome.

“Meehl’s *Clinical versus Statistical Prediction* (1954) ... concluded that (unaided) clinical judgment is unable to outperform, and is usually inferior to, judgment based on actuarial models. The recent fast and frugal heuristics program seems to conflict with this conclusion, showing that simple heuristics, proposed as plausible models of clinical judgments, can outperform standard actuarial models.”<sup>6</sup>

So it is found that in some problems, statistical reasoning is superior to clinical, but heuristics can improve on statistical methods.

So where does that leave us? Has the entire path of the development of human thinking been a waste—if a good heuristic can do better than the statistics that are better than the experts?

It actually leaves actuaries in a good place. We tend to be pragmatic problem solvers. As Bridgeman says above, we seek to “integrate all.” So, the true actuarial method is a blend of all three modes of thinking.

“To gain insights about future possibilities, the actuary depends on observation and wisdom gained through prior experience. Actuaries use these observations and experience to construct, validate and apply models. Actuaries continually incorporate additional observations and insights into their models. This feedback cycle systematically addresses discrepancies between these models and observed reality.”<sup>7</sup>

We just need to be careful as we are going down the path of more and more complex statistical models that we find ways to integrate the judgment of experts and the heuristics of the canny observers of human experiences. And especially that we do that early in our processes to make us smarter modelers. Otherwise, we may end up acting more like the primitive runners chasing down the prey of the modeled answer to the point of utter exhaustion. ■

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#### ENDNOTES

- <sup>1</sup> Rationality for Mortals—How People Cope with Uncertainty, Gerd Gigerenzer (2008).
- <sup>2</sup> Gigerenzer (2008).
- <sup>3</sup> “Clinical versus Statistical Prediction, A Theoretical Analysis and a Review of the Evidence,” 1954, University of Minnesota.
- <sup>4</sup> Dean R. Cauley Ph.D., MBA, Board Certified Forensic Mental Health Evaluator.
- <sup>5</sup> Jim Bridgeman, FSA.
- <sup>6</sup> *From Meehl to Fast and Frugal Heuristics (and Back) New Insights into How to Bridge the Clinical-Actuarial Divide*. Konstantinos V. Katsikopoulos, Thorsten Pachur, Edouard Machery, Annika Wallin. Max Plank Institute (2008).
- <sup>7</sup> “Principles Underlying Actuarial Science.” Mark Allaben, Christopher Diamantoukos, Arnold Dicke, Sam Gutterman, Stuart Klugman, Richard Lord, Warren Luckner, Robert Miccolis, Joseph Tan (2010).