A SOLUTION FOR COLLAPSED THINKING: SIGNAL DETECTION THEORY

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We perceive the world through our senses. The brain-mediated data we receive in this way form the basis of our understanding of the world. From this becomes possible the ordinary and exceptional mental activities of attending, perceiving, remembering, feeling, and reasoning. Via these mental processes, we understand and act on the material and social world.

In the town of Pondicherry in South India, where I sit as I write this, many do not share this assessment. There are those, including some close to me, who believe there are extrasensory paths to knowing the world that transcend the five senses, that untested "natural" foods and methods of acquiring information are superior to those based in evidence. On this trip, for example, I learned that they believe that a man has been able to stay alive without any caloric intake for months (although his weight falls, but only when he is under scientific observation).

Pondicherry is an Indian Union Territory that was controlled by the French for three hundred years (staving off the British in many a battle right outside my window) and that the French held on to until a few years after Indian independence. It has, in addition to numerous other points of attraction, become a center for those who yearn for spiritual experience, attracting many (both whites and natives) to give up their worldly lives to pursue the

advancement of the spirit, undertake bodily healing, and invest in good works on behalf of a larger community.

Yesterday I met a brilliant young man who had worked as a lawyer for eight years and now lives in an ashram and works in its book-sales division. "Sure," you retort, "the legal profession would turn any good person toward spirituality," but I assure you that the folks here have given up wealth and a wide variety of professions to pursue this manner of life. The point is that seemingly intelligent people seem to crave nonrational modes of thinking.

I do not mean to pick on any one city, and certainly not this unusual one in which so much good effort is spent on the arts and culture and social upliftment of the sort we would admire. But this is also a city that attracts a particular type of European, American, and Indian-those whose minds seem more naturally prepared to believe that herbs do cure cancer and standard medical care is to be avoided (until one desperately needs chemotherapy), that Tuesdays are inauspicious for starting new projects, that particular points in the big toe control the digestive system, that the position of the stars at the time of theii birth led them to Pondicherry through an inexplicable process emanating from a higher authority and through a vision from "the Mother," a deceased Frenchwoman who dominates the ashram and surrounding area in death more thoroughly than many skilled politicians do during their terms in office.

These types of beliefs may seem extreme, but they are not considered so in most of the world. Change the content, and the underlying false manner of thinking is readily observed just about anywhere. The twenty-two inches of new snow that fell recently where I live in the United States will no doubt bring forth beliefs of a god angered by crazy scientists touting global warming.

As I contemplate the single most powerful tool that could be put

into our toolkits, it is the simple and powerful concept of "signal detection." In fact, the *Edge* Question this year happens to be one I've contemplated for a while. I use David Green and John Swets's *Signal Detection Theory and Psychophysics* as the prototype, although the idea has its origins in earlier work among scientists concerned with the influence of photon fluctuations on visual detection and of sound waves on audition.

The idea underlying the power of signal-detection theory is simple: The world provides us with noisy, not pure, data. Auditory data, for instance, are degraded for a variety of reasons having to do with the physical properties of the communication of sound. The observing organism has properties that further affect how those data will be experienced and interpreted, such as auditory acuity; the circumstances under which the information is being processed (e.g., during a thunderstorm); and motivation (e.g., disinterest). Signal-detection theory allows us to put both aspects of the stimulus and the respondent together to understand the quality of the decision that will result, given the uncertain conditions under which data are transmitted both physically and psychologically.

To understand the crux of signal-detection theory, each event of any data impinging on the receiver (human or other) is coded into four categories, providing a language to describe the decision. One dimension concerns whether an event occurred or not (was a light flashed or not?); the other dimension concerns whether the human receiver detected it or not (was the light seen or not?). This gives us a 2 x 2 table of the sort laid out below, but it can be used to configure many different types of decisions. For example, were homeopathic pills taken or not? Did the disease get cured or not?

Did the event occur?		
	Yes	No
Yes	Hit	False Alarm
Was the event detected?		
No	Miss	Correct Rejection

Hit: A signal is present, and the signal is detected (correct response)
False Alarm: No signal is presented, but a signal is detected (incorrect response)
.Miss: A signal is present, but no signal is detected (incorrect response)
Correct Rejection: No signal is presented, and no signal is detected (correct response)

If the signal is clear, like a bright light against a dark background, and the decision maker has good visual acuity and is motivated to watch for the signal, we should see a large number of Hits and Correct Rejections and very few False Alarms and Misses. As these properties change, so does the quality of the decision. It is under ordinary conditions of uncertainty that signal-detection theory yields a powerful way to assess the stimulus and respondent qualities, including the respondent's idiosyncratic criterion (or cutting score) for decision making.

Signal-detection theory has been applied in areas as diverse as locating objects by sonar, the quality of remembering, the comprehension of language, visual perception, consumer marketing, jury decisions, price predictions in financial markets, and medical diagnoses. The reason signal-detection theory should be in the toolkit of every scientist is because it provides a mathematically

rigorous framework for understanding the nature of decision processes. The reason its logic should be in the toolkit of every thinking person is because it forces a completion of the four cells when analyzing the quality of any statement, such as "Good management positions await Sagittarius this week."