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How Do Cognitive Pitfalls Limit Our Ability to Anticipate Rare Events?

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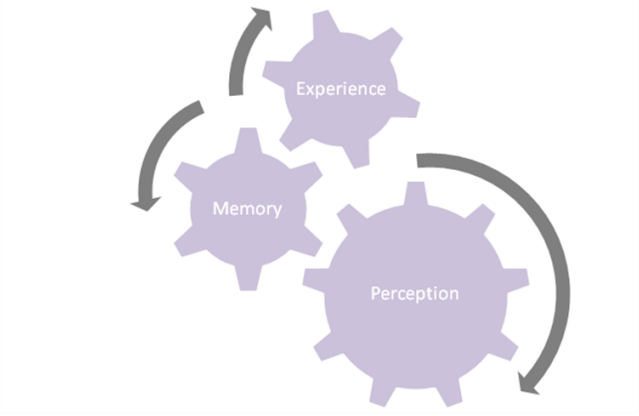
This article appeared in "Anticipating Rare Events: Can Acts of Terror, Use of Weapons of Mass Destruction or Other High Profile Acts Be Anticipated? A Scientific Perspective on Problems, Pitfalls, and Potential Solutions," in November 2008. The article is part of a collection that was published by the Topical Strategic Multilayer Assessment, Multi-Agency/Multi- Disciplinary White Papers in Support of Counter-terrorism and Counter-WMD in the Office of the Secretary of Defense/DDR&E/RTTO.

What is it in our cognitive process that makes it so difficult to anticipate rare events? Rare events by definition are uncommon, but the cognitive processes that seem to limit our ability to anticipate them are not. Neuroscience, psychology, biology, and simple experience have taught us much about how the brain works and the factors that can help—and hurt—our ability to anticipate rare events. Rare events, by their very nature, are almost impossible to predict. We can do a better job of anticipating them, however, if we learn more about how our brain works and why it gets us into trouble. Although we may not be able to predict rare events, we can reduce the chances of being surprised if we employ measures to help guard against inevitable cognitive pitfalls.

An understanding of the human cognitive process begins with acknowledging the vast capacity of the human brain, with its roughly 100 billion neurons. Such immense cognitive capacity facilitates fast thinking and effective cognition, but there is a hitch: the things that help us efficiently recognize patterns and quickly perform routine tasks can also lead to inflexible **mindsets**, distorted **perceptions**, and flawed **memory** (see Figure 1). These cognitive realities prove most often to be at the heart of faulty thinking and failures of analytic imagination.

The ramifications of these seemingly minor hitches can be devastating. For example, they can produce upsets in athletic competitions when coaching staffs fail to anticipate innovative game plans used by rival teams. They can prevent businesses from anticipating the competitive threats of new technologies and business practices, resulting in lost market share or corporate failures. And for war fighters, this can lead to tragic loss of life, as happened in the attack on the USS Cole.

Figure 1 Mindsets: Unavoidable But Surmountable



Mindsets are an unavoidable result of the method by which our brains process experiences and store information as memories based upon our perception of what we experience, rather than an exact copy of what occurred. Over time and with the right practice, we can overcome these cognitive pitfalls in order to help ourselves think creatively about the future and improve our ability to anticipate the precursors of rare events.

Postmortems of virtually every major intelligence failure over the past two decades have identified ingrained analytic mindsets as a key contributing cause. Mindsets, as bad as they may sound, are neither good nor bad, they are simply unavoidable.[i]

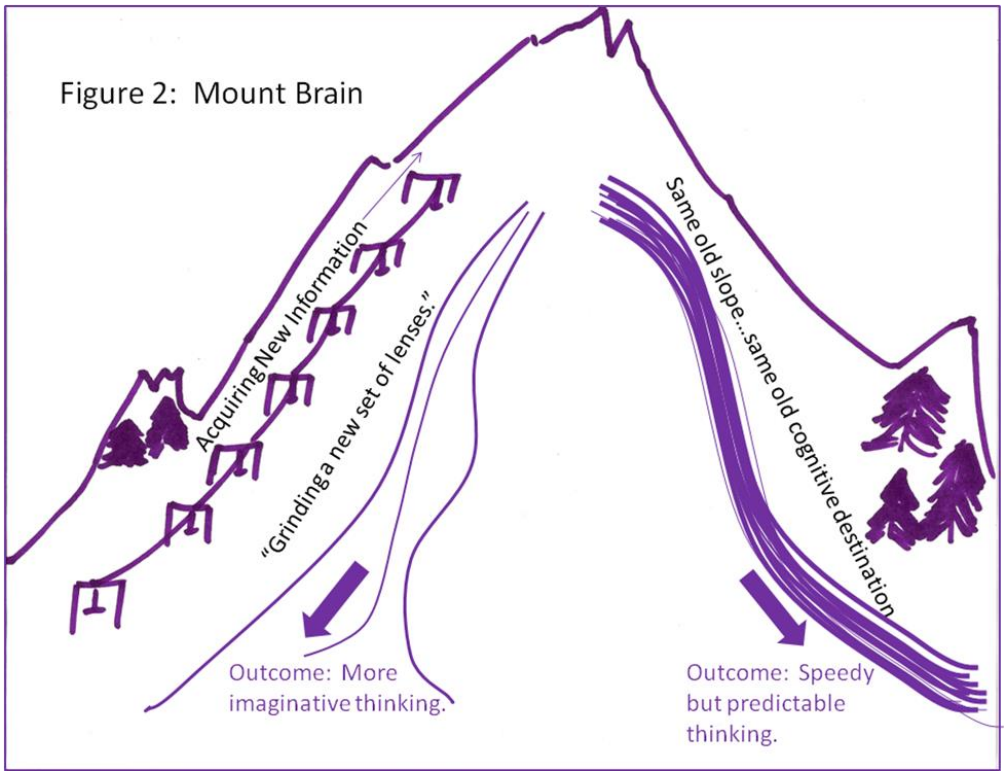
Take, for instance, a recent Stanford study in which 48 students, half of whom said they favored capital punishment and half of whom said they opposed it, were presented with two pieces of evidence, one supporting and one contradicting the claim that capital punishment deters crime. Both groups were more convinced by the evidence that supported their initial position.[ii]

The Stanford students were, in a sense, tricked by their over-efficient brains. Neuroscience tells us that whenever two of our neurons are activated, the connections or "synapses" between them are strengthened. Much like muscles, the more frequently those same neurons are activated, the stronger the path between them.[iii] The pitfall for the Stanford students—or for anyone who is asked to consider new information or think creatively about the future—is that once you have started thinking about a problem a certain way, the same mental circuits or pathways are activated and strengthened each time you think about it. On the positive side, this process facilitates efficient retrieval of information. On the downside, these pathways become the mental ruts that make it difficult to reorganize, reconsider, or in a more general sense, think creatively about the information. This is what makes mindsets so easy to form and so extraordinarily difficult to overcome.

Just as these cognitive ruts can distort the ways we process new information, they can also interfere with the ways we recall old information—our memory. Memory—both short and long-term—plays a critical role in our ability to deal with time pressure, large volumes of information, and multiple competing priorities. To process large amounts of new information quickly, our brains compare each new bit of data to old information that we have stored in memory—but as the volume of information mounts, we become increasingly inclined to recall evidence that supports our favored hypothesis and to ignore or reject information that is inconsistent with it. This phenomenon is readily apparent in another recent study with a group of Stanford students in which the subjects were exposed repeatedly to an unsubstantiated website claim that Coke is an effective paint thinner. Students who read the statement five times were nearly one-third more likely than those who read it only twice to attribute it to the reputable Consumer Reports rather than the less reputable National Enquirer. In essence, their memories, when retrieving the information, gave the claim a degree of credibility even though the statement was false.[iv]

Mental Ruts: Why We Like to Follow the Same Tracks in the Snow

One prominent neuroscientist calls this process the "plastic brain."[v] In contrast to elastic, which always returns to its original shape, Boston neuroscientist Alvaro Pascual-Leone explains that the plastic brain is changed with every experience. Much like a snowy mountain in winter, if we ski down it—or think about a particular problem—we will make a path in the snow. What is fascinating is that each time we think about the same problem or ski down the mountain, we will be more likely than not to take the same general path. The more we use these ruts in the snow, or mental tracks, the speedier, but more predictable, the path becomes. For "Mount Brain," this predictability can lead to either good or bad habits (see Figure 2). Pascual-Leone notes that over time our "ability to take a different path becomes increasingly difficult. A roadblock of some kind is necessary to help us change direction."[vi] More or even better information is not sufficient to bump our thinking out of these tracks and into new ones. Indeed, as John Seely Brown has noted, "instead of pouring knowledge into people's heads, you need to help them grind a new set of eyeglasses so they can see the world in a new way."[vii]



The lesson we can take from Pascual-Leone's work and the Stanford study is that while the brain's efficiency allows it to reach a judgment or decision quickly by utilizing the same synapses and well-worn pathways through the brain, these pathways will exclude other more imaginative routes that might lead to a different and more accurate answer. We assume that the homogeneous answer produced by this process is right not because it is, but because we arrive at this same answer each time we think about it. A further complication is that this result—or how we perceive the result—is often more a product of our expectation than what is actually occurring (see Figure 3).[viii]

Figure 3: The Role of Perception

In *Psychology of Intelligence Analysis*, Richards Heuer uses this graphic to illustrate the role that perception plays in analysis, noting that we tend to see what we expect to see. Look at the three figures above and say out loud what is printed in each triangle. Did you notice that the article "the" appears twice in the first triangle? What articles are repeated in the other two triangles? Our expectations make it highly difficult for us to notice that one article is repeated in each triangle. This is the result of perception, mindset, and our over-efficient brains at work.

Insufficient Mental "Bins"

Another cognitive obstacle to perceiving rare events is the tendency of human beings to categorize and simplify what they perceive. It is easier to understand a complex world if you can organize it. The fewer bins or labels you employ, the easier the task. This tendency to categorize and oversimplify makes it much easier—and quicker—to process data, but it also desensitizes the individual to anomalies or behaviors that do not fit into traditional patterns and may be a precursor to significant, major new developments.

An example of this phenomenon occurred when some of the 9/11 terrorists took pilot training. While this behavior was observed and reported, it did not send up a sufficient warning flag because government officials did not have an appropriate "bin" in which to put and think creatively about the information. They were accustomed to terrorists who hijacked airplanes but then landed and made demands while threatening the lives of their hostages; they did not have a sufficiently developed "bin" for terrorists who were planning to crash the

airplane, killing the passengers and themselves. The 9/11 Commission Report notes that "since al Qaeda and other groups had already used suicide vehicles, namely truck bombs, the leap to the use of other vehicles such as boats (the Cole attack) or planes is not far-fetched." And while "at least some government agencies were concerned about the hijacking danger and speculated about various scenarios" they had failed to meet "the challenge…to flesh out and test those scenarios, then figure a way to turn a scenario into constructive action." As a result, they did not create a new bin that would have allowed them to consider the use of a large, fully-fueled passenger airplane as a weapon. The full effect of the failure to develop a new bin was not felt until the 9/11 attacks themselves.

We Can Challenge Our Mindsets

The first failure of mindset and memory traps is a failure to recognize that they are an inherent part of being human. Knowing that our natural tendency is to put things into existing "bins" rather than ask if new "bins" should be created is a key first step. Knowing that we should lay down new tracks in the snow because it could lead to a different, more imaginative result is also essential. The second failure is our failure to take steps to challenge them. We first must recognize our analytic assumptions, our beliefs, and our insecurity in knowing that we do not have all the information. Then we can challenge our mindsets in order to be open to new information and new ways of thinking about it.

Rare events present tough cognitive challenges that are difficult, but not impossible, to overcome. It is exceedingly difficult to overcome the challenges of mindset, perception, and memory unless we actively challenge our ingrained cognitive processes. If the impetus for doing so is not obvious at first, we will naturally want to continue to find patterns and connect the dots, and will continue to do so until we recognize that the potential cost of doing so is failure. This is true even if most of the time we are lucky enough to choose the correct mental mindset and experience a speedy and accurate outcome.

Simply sensitizing ourselves to these cognitive glitches, however, is not enough. Thankfully, the human brain can change itself; it just needs encouragement to do so. Past experience shows that we can overcome the challenges of cognitive and memory pitfalls, but it takes practice—with the proper exercises—over time. Like any fitness program, cognitive improvements come gradually, with daily exercise, and the full extent of our improvement is often hard to recognize until the day of the competition.

[i] Richards J. Heuer, Jr., *Psychology of Intelligence Analysis*. Washington: Pherson Associates, (2007) p. 10.

[ii] Sam Wang and Sandra Aamondt, "Your Brain Lies to You," *New York Times*, (27 June 2008), www.nytimes.com.

[iii] Richards J. Heuer Jr., "New Approaches to Challenge Analysis," Unpublished Paper, 2008.

[iv] Sam Wang and Sandra Aamondt, "Your Brain Lies to You," *New York Times*, (27 June 2008), www.nytimes.com.

[v] Norman Doidge, The Brain that Changes Itself: Stories of Personal Triumph from the Frontiers of Brain Science New York, Penguin, (2007) 209.

[vi] *Ibid*. 210.

[vii] John Seely Brown and William Ellet, *Seeing Differently: Insights on Innovation*, Boston: Harvard Business Press, (1997) 216.

[viii] Richards J. Heuer Jr., "New Approaches to Challenge Analysis," 2008.