

Decision Science, Applied Neuroscience and Emerging Possibilities

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Abstract

Decision-making has been called the “brain and nervous system of the organization”. If the brain and nervous system analogy fits, how does this organizational and individual regulatory system actually function in the decision-making process? Neuroscience can now explain what goes on in the individual brain and nervous system as it makes decisions. This overview describes decision making strengths but also shortcuts, simplifications, biases, and basic bad habits of the brain and nervous system demonstrating that brains, both individually and collectively, can be deceptive guides for rational decision-making in emergent situations. Current decision science points to the limits of decision making theory based on pre-existing frames of reference and knowledge. Cognitive/behavioral researchers are developing strategies to structure decision processes designed in order to compensate for flawed or restricted thinking. Recent neuroscience focuses on ways in which mindfulness and working memory training can develop the brain's capacity for more conscious processing and open the mind to new and more creative possibilities.

Introduction

Deciding is what business people do. They identify problems and opportunities and make management choices everyday upon which growth, failure, or prosperity depends. Given the centrality of decision-making in business, theorists are continuously trying to improve decision-making quality. The decision-making function has in fact been called the “brain and nervous system of the organization” (1). If the brain and nervous system analogy fits, how does this organizational and individual regulatory system actually function in the decision-making process and how does the nervous system shape business decisions? Brain science can now explain what goes on in the brain and nervous system as it makes decision. This research is shedding light on cognitive strengths and is also highlighting cognitive shortcuts, simplifications, biases and basic bad habits. Behavioral decision research demonstrates that brains, both individually and collectively, can be deceptive guides for rational decision-making (2,3). This overview of current decision literature points out the limits of decision-making that is based on pre-existing frames of thinking and knowledge. Ways in which cognitive/behavioral researchers structure decision processes to compensate for flawed or restricted thinking are also reviewed. Finally, neurological research focusing on mindful awareness and working memory training are considered. Since neuroscience has established that mindfulness can restructure thinking to allow for new and more creative

possibilities and working memory training can expand the capacity for in the moment consciousness, a mind fitness training program is proposed.

Decision Theory History Summary

Intellectual disciplines - mathematics, philosophy, sociology, political science, and economics to name a few – concern themselves with decision science and have traditionally focused on optimizing rational decision-making models. Until recently one could not see inside the working brain, decision-making strategies were developed by observing human behavior from the outside relying on untested assumptions about how the brain works. Formal decision theory originated in the mathematics of probability. It rested on a four-step process of rational analysis closely resembling the scientific method i.e., it was inquiry based:

- proposing a hypothesis as a possible framework
- designing an experimental study to test the hypotheses
- gathering observable, empirical and measurable evidence through experimental interventions
- analyzing the observed behaviors and outcomes to see whether or not the hypothesis is at least statistically acceptable

This process was believed to be objective and, therefore, the interpretation of results as unbiased as possible. Organizational theorists have spent decades developing theories to support optimal decision-making skills that focus on this mode of analysis. In practice however, business people often find those decision techniques do not take into account all situational variables or they may be too cumbersome to apply systematically and in the moment. The volatile world of business decision - making requires focusing on either fragmentary, inadequate data or on massive amounts of information that must be correctly prioritized in a very short time. According to Max Bazerman (2006), most people fail to bring the right information into their conscious awareness at the right time.

State of the Art Decision Theory

Rational analysis works best with decisions that can be characterized as step by step. This involves a thorough analysis of all alternatives and their consequences so that the best possible alternative is selected. Organizational decision-making can be divided into two stages: problem identification (diagnosing the causes of shortcomings) and problem solution (choosing which available alternative should be implemented). The rational decision maker is assumed to have complete information, is able to identify all relevant options, and choose the option with the highest utility. However, decision criteria and consequences are complex. One simply cannot access all the information and this ideal model is unattainable. Standard theory in most organizational behavior texts discuss “satisficing or good enough” decisions (1, 4). The day-to-day business world experience points to the reality that optimal information is usually available only for long range planning. Decisions vary between routine and highly complex and can be categorized as programmed and non-programmed (1).

Programmed decisions are well understood, repetitive, and well defined. Often prototypes exist or can be adapted to resolve the issue. An example of programmed decision-making using an existing prototype was the Safeway corporate response to spiraling health care costs. Through research and analysis they determined that 70% of health-care costs are the result of behavior and that four chronic conditions (i.e. cardiovascular disease, cancer, diabetes and obesity) comprise 74% of all health care costs. They also learned that most of these conditions are preventable. In response to this information, a plan was developed that would help prevent these conditions by encouraging behavior that supports healthy lifestyles and discourages the development of preventable disease. The plan was borrowed from the well-tested automobile insurance prototype that correlated driving behavior with accident risk (5).

After the fact, this solution seems logical and straightforward. Actually, the road to that decision was long and arduous. It involved complex, non-programmed decision-making scenarios. The plan grew out of the larger context of retail grocers' survival in the face of wholesale competition. Safeway estimated that it was three years away from bankruptcy in 2005 (5). Safeway could not continue to bear the burden of paying all health benefits cost. First, Safeway management formed a coalition with competitors such as Ralphs, Albertsons, etc. and they agreed across the board, to maintain the 2003 benefit levels in all chains. Although this joint decision did indeed curtail tremendous cost outflow, it was met with protest marches and picketing. As described in the previous scenario, this decision was followed by the development of a new model for reducing health care costs. The solution required not just the reasoned, incremental, balancing of alternatives that decision-theory suggests; but, an understanding of the embedded, multiple perspectives of all the stakeholders. Reasoning skills transcending rationality and involving the messy human world of negotiation, motivation, power relationships and emotions were called for. Decision processes in organizational settings such as these are greatly affected by how much managers agree about the nature of the problem, which outcomes should be pursued, and whether or not there is support for a predictably unpopular solution through bargaining and coalition formation as in the Safeway problem above.

The process of deciding is often based on fragmentary information and is a random and unsystematic process. The "garbage can" model is an interesting description of decision-making that focuses not on how a single decision is made but on the flow of multiple decisions within organizations. The "garbage can" is an image describing decisions based less on rationality/logic and more on availability where participants, problems, choices or opportunities, and solutions float around. In this haphazard process if these four factors happen to connect, the decision is made. But it is a good process, producing desired outcomes, only if the right participants find the right solution to the right problem at the right time (1).

Intuitive Decision-making

Decision-makers sometimes rely on non-logical processes such as intuition. These non-quantifiable hunches have been the subject of considerable research. Theorists studying the power and perils of intuition as a decision tool find that intuition or "gut

feeling” is often used under conditions of high uncertainty and high pressure such as in firefighting and intensive-care emergencies. Managers may rely on intuition using judgment based on long years of experience that is stored in their subconscious. The danger of using intuition in novel situations is that the leader bases decisions on old information. If there is no predictability because the situation is completely new, then there is no basis for intuition based on experience. This may be reflected in leader overconfidence (10). Intuitive decisions are by their very nature biased because they are individual and are not subject to the scrutiny required of a rational process even though the outcome may work.

Many managers work between two extremes: making arbitrary decisions without careful study (intuitive) or relying obsessively on numbers and rational analysis. Organizational decisions are further complicated by the fact that most decisions are influenced by internal organizational structure, environmental stability. They may involve many departments and multiple viewpoints that are beyond the scope of one individual. Decisions made in these cases require more than the management of facts. They require fluid intelligence or the ability to reason and to solve new problems as they arise independently of previously acquired knowledge. Emotional and social intelligence are also needed in order to understand and manage individual decisions and to clearly communicate with and interact reciprocally with groups, teams, and coalitions. Social/emotional intelligence is well recognized as Daniel Goleman and others have established a new perspective on what it means to be intelligent (11,12,13,14,15,16).

Human Cognitive Limitations and New Directions for Decision Science

Neurological research demonstrates that the human brain doesn't always process information in a linear, logical fashion (6 p.xv). In situations where decisions with serious or long-term consequences must be made in the heat of the moment, one often does not reason the way through by carefully reflecting on the best course of action even though decision science does insist that this logical method is most prudent. The limits of our capacity to process volumes of information are well known (7,8,9,1). Behavioral economist Charles Roxburg (2003) cites eight common flaws in both individual and collective thinking that include 1) overconfidence in accurate estimates and in our own ability 2) accounting decisions based on where the money comes from – if only winnings are lost it is not a real loss, 3) status quo bias in favor of hanging on to what we have, 4) anchoring to previous information – it is dangerous to anchor in the past when the future is completely unrelated to the past, 5) throwing good money after bad – we have a strong aversion to loss, 6) the herding instinct - following the herd rather than relying on one's own information and analysis can be almost irresistible, 7) humans are not good at estimating how much pleasure or pain they will feel if circumstances change dramatically, and 8) humans overestimate how much others share their views, beliefs, and experiences leading to a) selective resources confirmation bias – we seek out information that support our own hypothesis, b) selective recall – remembering only the facts that reinforce our assumptions, c) biased evaluation – impute hostile motives to critics and d) group think pressure to agree with others (3).

In recent books such as Nudge (8) and Why We Make Mistakes (9), systematic biases in the way we perceive reality and how these biases cause human mistakes are outlined:

“We are all afflicted with certain systematic biases in the way we see, remember and receive the world around us, and these make us prone to commit certain kinds of errorsright handed people, for instance, tend to turn right when entering a building, even though that may not afford the best route to take . . . and we are also so swayed by our initial impression of things that we are reluctant to change our first answer on exams; yet many studies have shown we would be better off if we did exactly this. (9 p. 2).”

Much has been written about human cognitive limitations. Because our brains have limited information processing capacity, decision makers cannot hold all available information in working memory even if they could access it. Even if humans had access to perfect information, they would still make irrational choices because of biases such as excessive optimism or pessimism, bounded awareness, or errors in framing. Cognitive biases fall into two categories:

Personal bias

- overconfidence, fixating on initial information and discounting subsequent data,
- focusing on the familiar – anything that reaffirms past choices
- judgements are based on readily available information
- increased commitment in spite of negative information

Group bias:

- group as a whole suppresses differing opinions
- groups comprised of risk averse individuals make more conservative decisions
- groups comprised of risk tolerant individual make riskier choices

Research shows opportunities to misjudge situations abound as we try to create order or patterns when there are random events, focus on decisions that brought success in the past instead of future demands, falsely believe that past events could have been accurately predicted in hindsight (9, 17) the list continues as scientists attempt to understand how the human brain processes information and how we actually make choices.

If we were trained to see the limits of our perception and the biases that subconsciously influence our decisions, we would be less vulnerable to the manipulation of others who may exploit these tendencies. Marketing minds exploit us when they create an architecture of choice that is designed to increase the likelihood that we will buy. Libertarian paternalism (8) is the label given to choice architects who design environments engineered to manipulate customers into making choices that increase sales or that even serve the common good. At Safeway, choice architecture is exemplified in the employee cafeteria. Healthy entrees are displayed prominently in the cafeteria line and are sold to employees at a discount as a way to encourage healthy behavior and to support a culture of health and fitness. This is purely voluntary, you can still order a

burger, fries, and a milkshake but it will cost you more. This can be interpreted as benevolent but it is also manipulation (5).

Mindful Awareness, Enhanced Attention, and Getting Smarter

Breakthrough neurological studies have demonstrated that through specific training, brain capacity can be increased so that one is more self aware and able to choose more consciously. We can be trained to more skillfully identify our own perceptual bias and the bias of others. Fluid intelligence, that complex human ability that allows us to adapt our thinking to a new problem or situation, can also be improved with specific training (18, 15). The ways in which previously acquired knowledge (crystallized intelligence) and thinking in the moment (fluid intelligence) can be better integrated is the subject of much neurobiological research. This research has established that, rather than having fixed capabilities, the brain's capacity for both crystallized and fluid intelligence is dynamic rather than static and modifiable rather than fixed so that intelligence is trainable to a significant and meaningful degree (16). Optimal decision-making demands a blend of both knowledge based perspectives and in the moment perspectives. The science of thinking smarter on this level is not yet mainstream (19). Even so, studies central to this groundbreaking research have spawned a multimillion dollar cognitive training industry that is just beginning to appear in business literature (18, 20).

What is Mindful Awareness?

Mindful awareness has been defined as a process of “bringing one’s complete attention to the present experience on a moment to moment basis” (21 p. 68) and “as paying attention in a particular way, on purpose, in the present moment, and nonjudgementally” (22 p. 4). Mindful awareness is a specific discipline whereby one intentionally and effortfully focuses attention on one aspect of being such as breath. On an anatomical level, the practice of intentional focus results in synaptic changes that alter the neural firing of the mind and brain. This is documented by neuroscientists in studies that show an altered brain – one that is more integrated due to a thicker middle cortex area (15). It is comparable to physical exercise to build strength and endurance and has also been called mental hygiene (14). Therapeutic applications of mindfulness practice in areas such as treatment for attention deficit disorder and for pain and anxiety management are currently well recognized (22,23,24,25,26).

Mindfulness research in the world of decision science is not as well established as in the therapeutic community although articles about cognitive fitness, intuition, and motivation that touch on neuroaffective science research are beginning to appear (27,28,29). Mindfulness awareness practice has been documented as means to improve executive functioning (i.e. to focus, manage tasks, and prioritize by enhancing the essential skills of focused attention and cognitive acuity (20). It has also been cited as a means to access and improve the neural mechanisms beneath social and emotional intelligence (14). The ability to track situations in the moment and maintain a deep intuitive or “gut” level understanding of what is happening in real time is a capability that scenarios such as the Safeway examples and other complex situations demand. Studies

have shown that even small doses of an active, effortful meditation practice may literally change brain structure that will improve focus and the ability to pay attention in the present moment. A University of Pennsylvania study (20) demonstrated how mindful awareness practice improved all three components of attention focus and performance:

- ability to prioritize and manage tasks and goals
- ability to voluntarily focus on specific information
- ability stay alert to the environment

Mindfulness discipline has previously been described in the context of contemplative religious practice that involves months of meditative practice in isolated circumstances. People who have made a commitment of this sort demonstrate significant gains in levels of conscious awareness (30,31). The good news from recent research is that significant changes in brain performance can be attained within 8 to 10 weeks and including 15 to 30 minute daily practice sessions. One can enjoy the benefits of a focused mind without a drastic life style.

Scientists have demonstrated that much of the information that we use to make decisions is “below our radar” - or subconscious and decision theorists acknowledge the strong influence of this data on thinking and rationality. Mindfulness is a way to access preconscious knowledge and through mindfulness, the brain can be conditioned to function more effectively during the decision making process. As distinct from the physical brain, the mind, according to Daniel Siegel, “is the embodied capacity to regulate and shape the flow of information and energy”. Mindfulness training produces what Siegel calls “mindsight” or the individual’s ability to watch their mind create meaning and regulate information and energy flow. (14). When this capacity for paying attention to intention is well developed, the mind is not pulled about by prior learning but is aware of how that learning is influencing thought in the moment. When one is aware, one is then free to make new choices and participate in an emerging reality rather than being stuck in the status quo.

Creative Decision Making in the Service of Emerging Realities

Because we are in a constant state of change and, given the velocity at which information and new situations come at us, often without conscious awareness, our brains evaluate information as good or bad, important and unimportant based on what we have learned in the past. We operate on automatic unless we make a conscious effort to watch our brain make sense of the situation. Breaking free from habitual thinking requires quality of consciousness that has been called mindful awareness, mindsight, or presence. Senge describes this quality of thought as a deeper seeing, the ability to act in the service what is emerging, to be fully conscious in the present. It is also the capacity to see the emerging reality and act in harmony with it. According to Senge, to be fully present requires a willingness to accept uncomfortable moments of “profound disorientation” in which our taken for granted ways of seeing and making sense of the world can come unglued (32 pp 38). Just as a fit body has endurance, strength, and flexibility, a fit mind has efficient capacities in categories of mental agility, attention, emotional intelligence, and situational awareness. To Senge, fully embodied presence of this sort is to become what George Bernard Shaw called “a force of nature” (32 pp 12-13).

Proposed Mind Fitness Training

A mind fitness training program suggested by this literature review would combine established brief mindfulness based meditation with proven working memory training. This combination would provide optimal efficiency in functional patterns of neural activity. According to Graham Dawes who is a Director of the Centre for Self-Managed Learning, Hove, UK, supports the mind fitness concept with the following:

“ It is a truism in today’s world to say that value has migrated from material to information, from brawn to brain. Yet how much attention are we really giving to cognitive development? ”

Daws go on to say that it is easier to find better ways to learn things than it is to improve that which learns. This paper attempts to illustrate the way in which cognitive capacities limit perceptions and therefore information. It then goes on to describe how neuroscience is opening the door to greater cognitive capacity development with the hope that the focus may change from what you can do to how you think in order to encourage flexibility of thinking, a positive approach toward change and the ability to engage in strategic thinking – all essential tools for business decision making (33).

Success in complex contemporary business environments demands such intellectual characteristics as attentional capacity, situational awareness, emotional regulation, mental agility, and adaptability. The mind fitness training outlined here should give employees skills that optimize performance and protect against challenges and stressors of the work environment (34). Mindfulness based brief meditation training is recognized as a means to reduce distress, enhance quality of life, and promote optimal health. Other benefits include improved attentional control, mental agility, emotional intelligence and situational awareness. This suggests that mind fitness training through mindfulness can be seen as a way to improve both employee well being and cognitive performance. Another type of training - cognitive fitness training - offers the possibility of substantial improvement in working memory capacity. An individual with better working memory will experience better ability to focus, resist distractions, and control impulses. The training benefits are comprehensive, but they all follow from increased working memory capacity. The primary objective of this training is to improve attention, but the overall effect is often described as more mature behavior. The effects are being able to stay focused, resist distractions, plan activities, complete tasks, and follow and contribute to complex discussions. The goal is improved professional performance and attentional stamina.

Conclusions Based on Applied Neuroscience

Companies can't afford to ignore the human factor in the making of strategic decisions. They can greatly improve their chances of making good ones by becoming more aware of the way cognitive biases can mislead them, by reviewing their decision-making processes, and by establishing a culture of constructive debate. (17). Sophisticated decision making techniques and highly developed information technology

systems can access and structure more information than ever before. However, final decisions still rest with humans who are charged with the responsibility to plan for organizational profitability, growth, and sustainability. The mind/brain can be strengthened to manage the effects of stress and to process more information more efficiently. Proper training can help direct mental energy and information toward focused problem solving and away from confusion, defensiveness, and negative behavior. Mind fitness training offers the capacity for greater cognitive and psychological resources so that individuals may act effectively in an environment that is volatile, overloaded with information, emotionally challenging and often morally ambiguous (34).

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