

: How do individual differences impact use of decision support?

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People differ in abilities, capabilities, attitudes, beliefs, biases and knowledge, among many possible characteristics. Our differences likely have an impact on our use of computerized decision support and our decision making behavior. Some of the relationships are systematic. Yet there remain many unanswered questions. For example, are people with high IQs more or less likely to use decision support? Are people with advanced degrees more likely to make effective decisions and use decision support? Are older people more reluctant to use decision support? Are people with certain characteristics more likely to be "rational" than people with another set of characteristics? We do not know the answers to these and many other related questions.

Psychological and biological differences exist among and between people and yet there are also similarities and patterns that are discernible. In a 1983 article, Huber examined prior research on cognitive style as it might impact MIS and DSS design. His conclusion was extremely negative: "the currently available literature on cognitive style is an unsatisfactory basis for deriving operational guidelines for MIS and DSS design." Sadly his argument seemed to generalize and negatively impact research on individual differences and DSS. It seemed that a specific DSS should be designed for some ideal or general user and indirectly vendors and builders concluded and promoted that anyone could use a specific DSS and perhaps with training derive all of the advertised benefits. "One size fits all" somehow became the design guideline for building any type of DSS.

The Myers-Briggs instrument identified four cognitive types: Intuitive Thinkers (NT), Intuitive Feelers (NF), Sensing Thinkers (ST), and Sensing Feeler (SF). Supposedly, sensors focus on the present and are concrete and literal thinkers. Thinkers are objective making decisions based on facts. ST people are critical thinkers oriented toward problem solving. These descriptions are based upon narrative at <https://personalitymax.com/personality-types/> .

Some research suggested that Sensing Thinker (ST) managers would improve performance with graphical, raw data reports. This finding, even if true, provides limited design guidance. The M-B cognitive style personality inventory creates a simple 2X2 categorization of people. Perhaps more sophisticated measurement of individual differences will find useful patterns to help designers create options to customize a specific DSS to better fit specific users. Perhaps a specific DSS can be better tailored to individual needs and requirements.

There are many individual differences that have been inadequately explored, including: ability, cognitive complexity, motivation, need for achievement, risk-taking propensity, academic

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background, intelligence, previous training, task familiarity, dogmatism, self-concept, self-efficacy, and self-esteem. These and other differences may be systematically related to human-decision-making behavior, effective use of decision support, need for decision support, and information processing proficiency. Also, everyone may not benefit from or be inclined to use decision support.

Factors like stress response, response to uncertainty, adoption of organizational norms of rationality, or neurophysiological responses and information processing capabilities may also be important to examine. For example, physical health and age may impact effective use of decision support

There has been some recent individual differences research, for example Penolazzi, Leone & Russo (2013) and Scheres and Sanfey (2006). Both studies examined how the degree individual differences impact decision-making behavior. Scheres and Sanfey concluded their experiment "showed that individual differences in Reward Responsiveness and Drive were linked to strategic decision-making in both the Ultimatum and Dictator Games, two commonly-used economic decision tasks. More broadly, these results demonstrate that investigating the role of psychological processes in these type of tasks can help gain a better understanding of the motives that underlie decision-making." Penolazzi et al. concluded "by increasing the conflict between short- and long-term gains in the Iowa Gambling Task (IGT) paradigm, the effects exerted by personality on decision making are more likely to emerge."

People learn different content and heuristics as well. Our mindware differs. Mindware is a term invented by cognitive scientist David Perkins. According to Stanovich (2009), it is defined as rules, procedures and other forms of knowledge that are stored in memory and can be retrieved in order to make decisions and solve problems. Stanovich also mentions something he calls strategic mindware, which refers to the disposition towards engaging the reflective mind. Halle (2011) asserts "A mindware gap occurs when the tools of rationality -- scientific thinking, probabilistic thinking and logic -- are not fully learned or not acquired at all." Mindware is internal to a person and decision support software is external and augments or supports a person's capabilities to act rationally and make better, more effective decisions. Mindware can complement or interfere with decision support software.

Cognitive neuroscience is concerned with the study of the biological processes and aspects that underlie cognition. Researchers often examine neural connections involved in mental processes. One area of the brain, the hippocampus, may be the center of emotion, memory, and more automatic functions like breathing, the heartbeat, and digestive processes. The hippocampus belongs to the limbic system and some evidence indicate it plays important roles in the consolidation of information from short-term memory to long-term memory, and in spatial memory that enables navigation. The limbic system also controls basic emotions (fear, pleasure, anger) and drives (hunger, sex, dominance, care of offspring) that can adversely impact rational decision making. For

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example, the fight-or-flight response (also called the acute stress response) is a physiological reaction that occurs in response to a perceived harmful event, attack, or threat to survival (Cannon, 1915). According to Cannon (1915), fear, rage, pain, and the "pangs of hunger" are all primitive experiences that are among the most powerful that determine the actions of men. Each can reduce the possibility of rational decision behavior.

Cognition or thinking is a complex concept that involves "intellectual function, memory, speech and language, complex perception, orientation, attention, judgment, planning, and decision-making". Poor cognitive function should result in poor decision making.

Fellows (2004) in a review article notes "Impaired decision making is recognized in neuropsychiatric conditions such as dementia and drug addiction, and the inconsistencies and biases of healthy decision makers have been intensively studied. However, the tools of cognitive neuroscience have only recently been applied to understanding the brain basis of this complex behavior."

Daniel Kahneman (2011) identifies two type of cognitive processes used in decision making, "fast and slow" processes. Fast, System 1 or Type 1 processes do not require conscious attention, do not need input from conscious processes, and can operate in parallel. Slow, System 2 or Type 2 require conscious effort, and generally only work one at a time. Type 1 processes provide judgments quickly, but these judgments are often wrong, and can be overridden by corrective Type 2 processes. Type 2 processes are computationally expensive. "System 1" is fast, instinctive and emotional; "System 2" is slower, more deliberative, and more logical.

Cognitive scientists recognize two kinds of rationality: epistemic rationality compares the rules of logic and probability theory to the way that a person actually updates their beliefs. Instrumental rationality is about making decisions that are well-aimed at bringing about what you want. Chater (2018) notes "the cognitive sciences, psychology, and economics are intimately linked in their interest in rationality. Foundational to most conceptions of rationality, judgment, and reasoning is a particular view of perception."

Huber (1983) cautioned that fitting decision support to user styles may actually reinforce the cognitive bias of an individual decision maker. Perhaps fitting decision support may correct biases as well. Rationality can be difficult to determine in a decision situation.

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