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Managing cognitive bias in safety decision making: Application of emotional intelligence competencies

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ABSTRACT

Safety leadership is often tasked with making critical decisions in the face of complex information and external pressures. Given situations with many variables and potential courses of action to be considered, the brain has evolved to attempt to simplify these judgmental operations. Consequently, at times the result may be flawed judgments concerning our assessments of future probabilities due to certain cognitive biases. These cognitive biases are systematic distortions of decision making arising from innate heuristics used to simplify large quantities of data (Krause, 2009) [1]. By developing a better understanding of the types of cognitive biases that influence decision making, steps can be taken to more effectively manage these bias. However, research has shown that technologies associated with training in statistical and probabilistic reasoning and cognitive repair techniques do not sufficiently address elements of intuitive belief and individual affect. Therefore, this paper suggests that certain Emotional Intelligence (EI) competencies, when applied to the individual decision making process, can be useful in mitigating the effects of cognitive bias. Emotional Intelligence can be defined as an array of interrelated emotional and social competencies, skills and facilitators that impact intelligent behavior (Bar-On, 1997) [2]. For the purposes of this paper competencies associated with the EQ-i $^{2.0}$, a revision of the original model by Reuven Bar-On, will serve as a template for discussion. The composite scales include Self-Perception, Self-Expression, Interpersonal, Decision Making and Stress Management. Certain scales are considered to be especially relevant to affect-based debiasing strategies. In addition to the potential benefits for the individual decision maker, leveraging EI competencies may positively influence team interactions in the process of safety decision making and promote an organizational culture more open to diversity of perspective.

1. Introduction

Safety and risk management (RM) protocols continue to evolve as evidenced by the extensive body of research in these areas and the applications of this evolving knowledge by many organizations, particularly those in the aerospace industry. Even though probabilistic risk assessment (PRA) continues to be refined, the complex environment of many safety decision scenarios makes clear the fact that individual decision makers will often still be influenced by the natural tendency to incorporate heuristics and their associated cognitive biases in the decision making process. Implementation of strategies to mitigate these effects in the individual decision maker can serve to bolster RM protocols. Implications for the larger systems and organizations are less clear as complexity increases and factors such as procedural algorithms, stakeholder interests, management structure and organizational culture drive higher level decision making processes.

There is a wealth of important research on the broad topic of judgment and decision making (JDM). However, due to the limited scope of this paper, discussion of decision making theory will be confined to those elements directly related to heuristics and bias. According to the heuristics and bias paradigm of human judgment, people typically use cognitive short-cuts to make probability assessments simpler, but at the expense of being more prone to error. This is a factor not only in predictions but also in retrospective judgments of probability [12].

The effects of bias on JDM have been the subject of investigation in many disciplines including safety, psychology, economics and systems engineering. Cognitive bias is not due to any inherent defect in the decision maker, but rather is related to natural cognitive processes involving efforts to simplify complex decision making operations. Although some attempts have been made to uncouple the rational from the more intuitive decision making

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process, in practice both will continue to exert their effects in natural settings.

In recent decades the construct of Emotional Intelligence (EI) has developed in an attempt to describe and quantify those aspects of intelligent functioning not measured by standard Intelligence Quotient (IQ) tests. Given that EI address elements of self-awareness, emotional regulation, decision making and stress tolerance, it is believed to have the potential to contribute to debiasing strategies in naturalistic settings. Additionally EI incorporates elements of social intelligence which could serve to improve interactions among those involved in a comprehensive RM program. This may be especially beneficial when considering multiple stakeholders with diverse values and perspectives.

2. Judgment and decision making

Many disciplines have contributed to the rich body of research in the area of JDM. For the purposes of this paper the focus is on the cognitive, affective and emotional components of JDM and their relationship to risk analysis. It is important to note that deterministic approaches to safety decision making have been supplemented with more comprehensive probabilistic risk assessment (PRA). This has led to a more integrated approach to safety decision making, which has been incorporated by agencies such as the National Aeronautics and Space Administration (NASA) and the United States Nuclear Regulatory Commission (USNRC) [15]. In addition, these agencies have developed a risk-informed decision making (RIDM) process which is integrated into their comprehensive RM processes. Zio and Pedroni (2012) [3] differentiate NASA's RIDM process from the USNRC in that NASA's focus seems to be on a combination of a better decision structure crossing internal organizational boundaries and support for multi-criteria decisions under uncertainty. NASA also describes RIDM as a fundamentally deliberative process that uses a diverse set of performance measures, along with other considerations, to inform decision making. The role of human judgment in decision making is also acknowledged [4]. Given this role in the deliberative process, NASA describes "decision traps" to be considered [5,6]. These decision traps fall under the broader category of heuristics and bias. NASA describes the RIDM process as a mechanism to avoid these traps by establishing a rational basis for decision making, ensuring that the implications of each decision alternative have been thoroughly analyzed and by providing a structured environment for deliberation, where the merits and drawbacks of each alternative can be discussed in the context of the risk analysis [5]. Despite the best of technical processes to avoid or mitigate errors in JDM, heuristics and bias will continue to be an area requiring consideration in safety and risk management programs.

2.1. Heuristics and bias

There has been extensive research done on what influences decision making, especially under conditions of uncertainty. Traditional models of decision making are constructed on logic and rationality. However in reality, decision making very often is influenced by a complex set of cognitive and affective variables. This process was described by Tversky and Kahneman (1974) [7] in their work on judgment and uncertainty. They proposed that intuitive judgments under uncertainty are typically controlled by judgmental heuristics rather than laws of probability. Generally a heuristic can be described as a "rule-of-thumb" or simplified, intuitive approach to decision making that may offer expedience at the risk of cognitive error (bias). It occurs most often in situations where information or cognitive capacity is limited and other pressures are influencing the process. Tversky and Kahnman highlighted the availability, representativeness and anchoring and adjustment heuristics, and their associate biases [5]. The availability heuristic describes the perception that the probability of an event occurring is based on the ease with which examples or occurrences come to mind. The representativeness heuristic refers to the tendency to evaluate probabilities based on initial impressions about how much something resembles a class or type. The anchoring and adjustment heuristic refers to the tendency to remain tied to an initial estimation or judgment, even when provided with information supporting significant readjustment. As research on JDM has evolved, the number of identified biases has grown significantly (Fig. 1).

Cognitive Biases

Anchoring – tendency to overweight the first information received

Confirmation Bias – placing more emphasis on information that supports currently held views

Framing – tendency to respond based on how information is presented

Hindsight Bias – tendency to see things as more predictable than they really are

Status Quo Bias – inclination to prefer the current state of affairs

Sunk-cost Bias – tendency to continue with a course of action in an attempt to recoup losses, despite rationale to do otherwise

Fig. 1. Common Cognitive Bias.

It has been proposed by Das and Teng (1999) [8] that the multitude of identified cognitive biases could be grouped into four categories: 1) prior hypothesis and focusing on limited targets, 2) exposure to limited alternatives, 3) insensitivity to outcome probabilities and 4) illusion of manageability. Other researchers (Teovanovic, et al, 2015) [9] have devised classifications of cognitive bias based on individual differences in information obtained from multiple tasks and measures. According to Korte (2003) [10] research has shown that decision makers tend to (a) reduce problems into simple constructs and (b) use information selectively based on their beliefs (assumptions and mental models) and preferences (biases). Decision makers often create analyses and solutions that reflect their experience and beliefs and interpret their experience in ways that support and preserve their beliefs [10,11]. Arkes (1991) states that a few general causes underlie a wide range of biases. He proposed three categories. The first two are attributed to an intuitive, non-conscious system (System 1) and the third attributed to an analytical, conscious system (System 2). The categories are: 1) psychophysically-based error, 2) association-based error and 3) strategy-based error [12]. The two system model will be described in more detail.

2.2. Two system model

In an effort to further explain the role of heuristics and bias in decision making, theories have evolved citing two primary processing modes for a cognitive task. Based on this dual process theory (DPT) dual-system models have been proposed. System 1, is considered to be intuitive, automatic and non-conscious. The second,

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