

## DIGITAL SOLUTIONS TO DECISION MAKING LIMITATIONS: FOR BETTER OR WORSE?

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### ABSTRACT

Since individuals are constrained in their ability to process information, they tend to engage in information processing shortcuts. When the individual is a member of the top management team with individual decision-making responsibility, not only is the information load very high, but the consequences of poor decisions can be wide reaching. Computerized Decision Aides have been widely employed to facilitate individual level decision making, however, in this article, the authors suggest that while these aides can have substantial beneficial effects, managers should be aware of the potential of some deleterious effects as well. Using a review of relevant literature, the authors explore ways in which Computerized Decision Aides can lead members of Top Management Teams to commit decision making errors which can lead to suboptimal outcomes. Specifically, there is potential that these aides can be used to reinforce existing biases and that managers may further rely on the information contained in the system exclusively, while not seeking information outside the system, and can lead to intuition atrophy. While the decision-making processes of the top management team have been widely studied, including many studies which evaluate the effects of Computerized Decision Aides, few have considered the potential deleterious effects of these aides.

**Keywords:** Decision Making, Computerized Decision Aide, Heuristic, Top Management Team

### INTRODUCTION

Recent trends such as globalization and privatization have created a dynamic and increasingly competitive environment for organizations (Son & Zohnhöfer, 2019). Consequently, managing and operating organizations have become increasingly complex and require extensive cognitive effort on the part of individuals at all levels of the organization (Bacon-Gerasymenko & Eggers, 2019). Organizations have responded to this cognitive demand during the past 30 years by creating large mechanical organizations aimed at reducing cognitive dissonance, by implementing standard operating procedures, and defining specific roles for individual employees (Weick, 1995). These efforts are likely to facilitate improved performance for operational level employees, however the cognitive demands

are just as strong for the top management team, which is charged with carrying out the firm's strategic decision-making activities.

Members of top management teams suffer from cognitive limitations just like any other group of individuals (Downen et al., 2018), in addition to suffering from certain group level phenomena which reduce decision efficiency (Sorkin et al., 2001). These shortcomings could potentially lead to less than optimal decision making that can cause organizational level performance to suffer (Walter et al., 2012). Many of these limitations can be overcome or at least mitigated through the use of computer supported decision making aides, while some of these limitations can be exacerbated by the use of such aides.

In this paper, we highlight some of the potential pitfalls of CDA for decision making by the top management team. Specifically, there is potential that these aides can be used to reinforce existing

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biases and that managers may further rely on the information contained in the system exclusively, while not seeking information outside the system. Further, top management teams that over rely on CDAs may develop dependency on them, reducing their capacity to make effective decisions in the absence of CDA, and in the event of unusual circumstances that require more human intuition than the CDA can accommodate.

This paper proceeds as follows. First, individual level cognitive limitations are discussed as they pertain to decision making. Second, computerized solutions (or at least treatments) for these limitations are presented. Three potential pitfalls are CDAs are then outlined, and implications for research and practice conclude the paper.

## LITERATURE REVIEW

### **Individual Level Limits to Cognition**

Bounded rationality theory (Walter et al., 2012), assumes that perfect information is available, and for each decision there is an optimal solution that can be arrived at via a process of rational evaluation. Under this theory, the role of the decision maker is to carry out this rational evaluation and arrive at the optimal decision. In practice, a number of cognitive limitations prevent decision makers from rational optimization. These limitations include selective perception biases and limited information processing as a result of heuristics and framing. Each limitation will be discussed in turn.

It has been noted that in complex situations individuals are more likely to engage in selective perception (Chang et al., 2010; Dearborn & Simon, 1958). As complexity rises, the ability of the decision maker to process information is constrained by their cognitive limitations (Furner et al., 2016), forcing the decision maker to ignore some information. Individuals are more likely to only consider that data which supports their pre-existing judgments (Furner et al.,

2017; Kumar & Goyal, 2015). Even if the decision maker is able to remain objective, they also tend to attribute more weight to information that they can easily understand (i.e. information relating to an area in which they have worked in the past, rather than an area that is new to them) (Schwarz et al., 1991). A lack of outside experience forces them to extend more cognitive effort in order to understand the information coming in from other areas, which can lead to feelings of distress. In a decision-making context, these individuals may have biases that cause them to overlook or ignore important information which can result in a suboptimal decision. As a result of biases and deviations from rationality, information overload can result in poor decision outcomes (Eppler & Mengis, 2004). According to Furner and Zinko (2017, p. 212), "information overload is a phenomenon in which a decision maker becomes overwhelmed by the information they are attempting to process." Because of being overwhelmed, information overload is tied to making decisions that have negative outcomes. To manage this, CDA are used, but there are limited factors that affect the positive effects of CDA. If there is too much information, managers will use their predetermined decision-making biases even when using a CDA. Effectively formatting and presenting data to management decision makers is beneficial for overcoming information overload.

Tversky and Kahneman (1974) note that in complex situations involving uncertainty individuals often employ heuristics to reduce the stressors tied to this uncertainty. These heuristics include representativeness, availability, and anchoring for uncertainty reduction. This allows the individual to estimate probabilities using simpler cognitive judgements (Kahneman & Frederick, 2002). Representativeness refers to the cognitive process of grouping individuals into classes using a few characteristics, and then projecting those characteristics onto each member of the

class. These projections can easily be erroneous. The availability heuristic refers to devoting extra attention to events that have occurred recently and which come to mind easily (Kahneman & Frederick, 2002). Finally, anchoring refers to setting a starting point for numerical calculations, then adjusting from that starting point rather than recalculating the value each time. These heuristics identified by Tversky and Kahneman illustrate some of the limitations of individual decision making. An individual's ability to process information (the basic process involved in decision making) is dependent on how the information (an outcome or a contingency) is framed, that is, the format in which it is presented (Tversky & Kahneman, 1981). For example, when an outcome is presented as "We expect a 40% fatality rate", the outcome seems less appealing than if it were presented as "We expect a 60% survival rate."

## **METHODS**

In order to identify potential pitfalls of excessive reliance on CDA, relevant literature from decision making, cognitive limitations and CDA are discussed.

### **Computerized Decision Aids**

Computerized Decision Aides can help overcome or can exacerbate selective perception bias. In this subsection, we highlight many of the benefits and three of the potential pitfalls of CDA for decision making.

### **Selective Perception Biases**

CDAs often incorporate features which assist information identification and retrieval. If a manager values the information from various areas of the organization, CDA can assist him or her by collecting and formatting information, and enabling communication with key personnel in the various areas of the organization. However, if the decision maker is truly biased, and only interested in the information related to his/her

functional area, or information which supports his/her prejudices, the CDA may be used as a tool to sort through the various information sources and identify only those which the decision maker is interested in. This may lead to stagnation and a systematic problem of limited information being used in decisions.

### **Heuristics**

The only advantage created by availability and representative heuristics (despite what Tversky and Kahneman, 1974 may argue) is information load reduction resulting in a reduced demand for cognitive effort (Furner, 2013). The interaction between an individual's use of these heuristics and use of CDA technologies can increase the likelihood of arriving at a suboptimal decision. CDA technologies can reduce the problems associated with anchoring, by providing quick calculation and summation tools that do not consume a great deal of cognitive effort.

When Tversky and Kahneman (1974) spoke of the representative heuristic, they were not only talking about intangible and tacit feelings that individuals associate with groups that are based on prejudices, they also referred to measurable characteristics such as hospitable size. CDA can be used to facilitate the use of representative heuristics, by enabling the decision maker to collect information, create groups, calculate scores for characteristics, and apply those scores to individuals.

CDA also exacerbate the negative effects of availability heuristics. Westrum's (1982) Fallacy of Centrality states that individuals ignore things that they cannot see. This carries the implication that in organizations, where nets of collective action define roles, if the nets are too complex, a lot of useful information will be ignored. Building on this, Weick (1995) points out that if individuals get important news late, they may think that it is not important, because if it were, they would have heard right

away. Weick goes on to identify implications for information systems, noting that people believe that either the information system should give them the info that they need right away, or that everything they need should come through the information system, and if something does not come through, it must not be important. Using Weick’s logic, it is easy to see how CDA (a class of the type information system) have the power to constrain individual information processing by imposing an availability heuristic. All in all, representative and availability heuristics may save some time and cognitive effort, however, they run the risk of leading to suboptimal decision making by limiting information processing.

**Framing**

By providing decision makers with a constant format for the information that they process, framing should become less of a problem for users of CDA. Since the formatting and organization of information can influence decisions (Knapp & Knapp, 2012), CDAs which employ standardized and consistent formatting and presentation should reduce selective framing. However, most CDAs today include a wide range of formatting, presentation, visualization and drill-down functionality. This can empower a decision maker who is already experiencing selective perception bias to develop visualizations which support their biases, by framing supporting data in a misleading way.

**Dependency**

Many decision making activities are straight forward optimization-under-constraint exercises which are easily programable, while other decisions benefit substantially from human intuition (Keith et al., 2013). Mascha and Smedley (2007) point out that as decision makers use CDAs, their ability to effectively apply intuition can atrophy, reducing their capacity to process complex and novel information to arrive at optimal decisions in

the future. Even minor deviations in presentation of information can add to perceptions of cognitive load when a decision maker is accustomed to a certain presentation (Kelton et al., 2010). If decision makers inadvertently deskill as a result of using CDA, novel problems that the CDA is not able to support might leave decision makers ill prepared to act rationally.

**FINDINGS**

Based on our review, we find that CDA can overcome a variety of decision making shortcomings, but can lead to a number of other behaviors which can limit the effectiveness of decision making. These are summarized in Table 1 Below:

**Table 1: Summary of Findings**

<b>Feature</b>	<b>Benefit</b>	<b>Risk</b>
Identification and Retrieval	Reduce Selective Perception Bias	Increase Selective Perception Bias
Consistency of formatting	More effective Framing	Increase Selective Perception Bias.  Visualization tools may improve the effectiveness of biased arguments
Optimization Tools	Efficiency for making routine and less complex decisions	Dependency which may erode complex decision-making capability

**CONCLUSION**

Individual decision making is prone to a number of weaknesses, however it is still the pivotal component of organizational decision-making, particularly for the top management team. While the popular belief among researchers is that Decision Support Systems (or CDA) can overcome many of

the cognitive limitations that create problems with the decision-making process, in many cases they interact with the limitations to further hinder individual decision-making outcomes. By recognizing the problems that may arise during the use of CDA, decision makers may be able to avoid suboptimal outcomes.

This paper carries implications for researchers. Recognizing the unintended consequences of otherwise productive systems is an understudied area of information systems research (Alberts, 1996). Further, researchers have the potential to develop models of information processing load and the associated shortcuts at the top management level using outcomes such as decision quality and antecedents such as the number and variety of information sources considered and the extent to which information search was for confirmatory rather than exploratory purposes. Doing so could deepen our understanding of the influence of DCA on heuristics and bounded rationality in decision making.

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